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Malheur National Forest

Blue Mountain Ranger District

Aquatic Resources Report

Camp Lick Project

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For:
Blue Mountain Ranger District
Malheur National Forest

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for the greatest good

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List of Acronyms

ARBO II	aquatic and riparian restoration programmatic consultation	MIS	management indicator species
BE	beneficial effect	MNF	Malheur National Forest
BMPs	best management practices	NEPA	National Environmental Policy Act
BI	beneficial impact	NFMA	National Forest Management Act of 1976
CFR	Code of Federal Regulations	NFS	National Forest System (Road)
DBH	diameter at breast height	NMFS	National Marine Fisheries Service
DFCs	desired future conditions	NI	no impact
DPS	distinct population segment	ODFW	Oregon Department of Fish and Wildlife
EA	environmental assessment	ORNHP	Oregon Natural Heritage Program
EFH	essential fish habitat	PAGs	plant association groups
ESA	Endangered Species Act of 1973	PCEs	primary constituent elements
FWS	U.S. Fish and Wildlife Service	PDCs	project design criteria
FR	Federal register	PIBO	PACFISH/INFISH Biological Opinion
GIS	geographic information system	PMM	positive, meaningfully measured
IMW	intensively monitored watershed	PNMM	positive, not meaningfully measured
LAA	may affect, likely to adversely affect	R6	Region 6, or Pacific Northwest Region
LWD	large woody debris	RHCA	riparian habitat conservation area
MCR	Mid-Columbia River	RMOs	riparian management objectives
MSA	Magnuson-Stevens Fishery Conservation and Management Act of 1996	RPMs	reasonable and prudent measures
MFJD	Middle Fork John Day (River)	T&C	terms and conditions
NMM	negative, meaningfully measured	TES	threatened, endangered and sensitive (species)
NNMM	negative, not meaningfully measured	TSS	total suspended solids
MIIH	may impact individuals or habitat	USDA	United States Department of Agriculture

Introduction

This biological evaluation and Aquatic Resources Report contains an analysis of existing and desired aquatic habitat conditions for the Camp Lick planning area and an analysis of effects from proposed activities on aquatic threatened, endangered, and Region 6 sensitive species (TES), the Malheur National Forest Land and Resource Management Plan (hereafter Malheur Forest Plan), aquatic management indicator species (MIS), and aquatic habitat.

The following attachments are included with this report:

- Appendix A: Available Region 6 stream survey data tables for fish-bearing streams within the planning area comparing existing condition with the Interim Strategies for Managing Anadromous fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (hereafter PACFISH, USDA Forest Service 1995a/b) riparian management objectives (RMOs), Forest Plan Amendment 29[1] desired future conditions (DFCs), and National Marine Fisheries Service (NMFS) and Fish and Wildlife Service (FWS) Matrix of Pathways and Indicators.
- Appendix B: Photos depicting existing stream conditions within reaches identified for aquatic restoration treatments as well as photos depicting existing conditions within the Camp Lick Project.

The following project design criteria (PDCs) are included as Camp Lick Project Environmental Assessment (EA) Appendix C and are incorporated herein by reference.

- General water drafting guidance for road maintenance and non-emergency fire use for watersheds with anadromous fish in the Blue Mountain Tri-Forest Area.
- National Marine Fisheries Service (NMFS) juvenile fish screen criteria for pump intakes.
- Relevant project implementation criteria for road maintenance activities as included in the 2010 Endangered Species Act (ESA) Section 7 informal consultation and Magnuson-Stevenson Act (MSA) essential fish habitat consultation for Malheur National Forest (MNF) road maintenance activities 2010-2015.
- Best management practices (BMPs) selected for project implementation.
- Camp Lick project design criteria (PDCs) relevant to aquatics.
- Aquatic and riparian restoration programmatic consultation (ARBO II, USDI FWS 2013) PDCs relevant to the Camp Lick Project.
- Malheur National Forest Aquatic Restoration Project Environmental Assessment and the Decision Notice for Aquatic Restoration Project, signed September 2014 (USDA Forest Service 2014a/b).

Summary of Effects

Effects of the Camp Lick Project on threatened, endangered, Region 6 sensitive, and management indicator species present in the aquatic analysis area were analyzed using two methods: 1) six primary habitat elements were used as a surrogate to determine effects of the Camp Lick Project on threatened, endangered, and Region 6 sensitive (TES) species, and Malheur Forest Plan management indicator species (MIS); 2) an assessment of actions that could directly affect TES and/or MIS species.

Negative or Neutral Effects

The analysis of effects of 7 grouped project elements on the six primary habitat elements determined that

[1] Amendment 29: Forest Plan amendment for incorporation of the Columbia River Basin Anadromous Fish Habitat Management Policy and Implementation Guide into the Malheur National Forest Land and Resource Management Plan. (USDA Forest Service 1994).

road decommissioning would have a negative and meaningfully measurable effect on the primary habitat element of embeddedness and fine sediment. The analysis determined that the effects of the remaining six project elements on the remaining five primary habitat elements were either negative and not meaningfully measurable or neutral (Table 17).

Positive Effects

All project elements except for: 1) temporary road and landing construction would have positive and meaningfully measureable effects to three or more of the primary habitat elements (Table 17). The Camp Lick Project would restore riparian processes and functions resulting in a positive effect on aquatic TES species.

Large woody debris (LWD) additions through the implementation of ecological riparian treatments, range improvements, road decommissioning, fuels treatments, and timber felling would all contribute to restoration of both upland and riparian processes and functions. Short-term negative direct effects to aquatic TES and MIS species are anticipated; however these effects would be minimized through implementation of a thorough set of PDCs including those developed from both the project interdisciplinary team and the aquatic restoration biological opinion (ARBO II) which incorporates the most current scientific conservation measures.

Regulatory Framework

This section describes relevant laws, management objectives, guidelines, direction, and recommendations to guide Forest Service management activities in the Camp Lick planning area. This information comes from a variety of sources. The Executive Order 12962 of 1995 (aquatic systems and recreational fisheries) requires federal agencies to conserve, restore, and enhance aquatic systems to provide for increased recreational fishing opportunities nationwide. The order requires federal agencies to evaluate the effects of federally funded actions on aquatic systems and document those effects relative to the purpose of this order. The two principle laws relevant to fisheries management are the National Forest Management Act of 1976 (NFMA) and the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). Direction relative to fisheries is as follows:

- NFMA requires the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife species and conserve all listed threatened or endangered species populations (36 CFR 219.19).
- ESA requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS) if a proposed activity may affect the population or habitat of a listed species.

The Forest Plan provides direction to protect and manage resources. Only direction pertaining to fish and fish habitat that has project relevance is included here (see Camp Lick Watershed Report for Forest Plan direction related to water quality).

Malheur Forest Plan Goals for Aquatic Resources

- Assist in the identification, protection and recovery of TES species (USDA Forest Service, Goal 15, page IV-2).
- Provide for improved fish habitat conditions to support increased populations of anadromous and resident fish (USDA Forest Service 1990, Goal 18, page IV-2).
- Provide a diversity of habitat sufficient to maintain viable populations of all species (USDA Forest Service 1990, Goal 19, page IV-2).

Malheur Forest Plan Objectives for Aquatic Resources

The Forest Plan objectives state how resources will be managed under the Forest Plan:

- Plan and design all management activities to avoid actions which may cause a species to become threatened and endangered. Critical habitat and other habitat necessary for the conservation of these species will not be destroyed or suffer adverse modification. All actions will be coordinated with other agencies as appropriate (USDA Forest Service 1990, page IV-17).
- Manage habitat of candidate species for listing as threatened or endangered in cooperation with the FWS. Monitor known populations and survey for additional populations with the cooperation of the Nature Conservancy and the Oregon Natural Heritage Data Base (USDA Forest Service, page IV-17).
- Cooperate with other resources such as timber, range, recreation, minerals, etc., to identify means of facilitating the achievement of fish and wildlife management objectives. Cooperate with other agencies and groups to promote mutual objectives including funding through the Challenge Cost-share Program and program accomplishment through use of volunteer efforts (USDA Forest Service 1990, page IV-17).
- Manage fish habitat and riparian areas to achieve increases in fish habitat capability. This habitat improvement will be accomplished by a combination of the following:
    (a) Implementation of livestock management strategies to achieve better distribution of livestock, and better control of forage utilization in riparian areas. This will help achieve a more diverse and abundant riparian vegetation condition and geomorphic recovery of the stream channel.
    (b) Implementation of the riparian timber management prescriptions, which will provide for improved stream shading and a better supply of large woody material to the stream channel.
    (c) Implementation of watershed and fish habitat improvement structures, to improve habitat conditions and accelerate geomorphic recovery of the stream channel (USDA Forest Service 1990, page IV-17).
- Similar management activities will be applied to resident and anadromous streams and riparian areas, but emphasis for appropriated funds will go to anadromous streams until major structural improvements are completed in most of these streams (USDA Forest Service 1990, page IV-18).

Malheur Forest Plan Forest-Wide Standards

Provide habitat requirements for the following selected management indicator species (MIS):

(a) steelhead trout, redband trout, and bull trout.

Meet all legal and biological requirements for the conservation of threatened and endangered plants and animals. Assess all proposed projects that involve habitat changes or disturbance and have the potential to alter the habitat of threatened, endangered or sensitive plant and animal species.

When threatened or endangered species or habitat are present, follow the required biological assessment process, according to the requirements of the ESA (Public Law 93-205). Meet all consultation requirements with the NMFS, FWS and state agencies (USDA Forest Service 1990, page IV-33).

Specify all protection or mitigation requirements (36 CFR 219.27(a)(8)) before project implementation begins. Manage all habitats for existing federally classified threatened and endangered species to help achieve recovery objectives (USDA Forest Service 1990, page IV-33).

Perform a biological (field) evaluation for use in planning of proposed projects when sensitive species are present or suspected. Conduct surveys in cooperation with other agencies and groups to document the

locations of sensitive species populations and to provide more specific information on habitat requirements and relative management guidelines (USDA Forest Service 1990, page IV-33).

Malheur Forest Plan Management Area 3B – Anadromous Riparian Areas

Riparian habitats are directly affected by water and exhibit either visible vegetation or physical characteristics reflecting influence from water. Management Area 3B consists of lakes, perennial streams and seasonally flowing streams; lands adjacent to lakes, perennial and seasonal streams; floodplains and wetlands; wet, moist areas such as meadows, springs, seeps, bogs, and wallows and quaking aspen stands in watersheds currently or potentially supporting anadromous fish. The following standards from MA3B are applicable to the Camp Lick Project:

- Standard 5: Provide the necessary habitat to maintain or increase populations of management indicator species with special emphasis on MCR steelhead.
- Standard 8: Manage the composition and productivity of key riparian vegetation to protect or enhance riparian-dependent resources. Emphasis will be on reestablishment of remnant hardwood shrub and tree communities.
- Standard 10: Improve the rate of recovery in riparian areas that are not in a condition to meet management objectives by eliminating or reducing impacts of management activities that may slow riparian recovery.
- Standard 34: Emphasize natural regeneration but plant when needed to meet riparian management objectives.
- Standard 41: Avoid locating roads in riparian areas while providing adequate local road access for management activities. Minimize the density of opens roads in this management area by obliterating, revegetating, or closing unnecessary roads or any roads causing significant resource damage.
- Standard 42: Design and maintain roads to protect fisheries values and riparian area habitat.
- Standard 43: Provide seasonal closures to reduce sedimentation.
- Standard 44: Leave stream channels of Class I to IV streams undisturbed by roads, except for crossings. Minimize adverse impacts to water and fisheries resources when designing necessary crossings.
- Standard 45: Apply erosion seeding on: (a) all disturbed soil that occurs within 100 – 200 feet of a Class I, II, III, or IV stream where eroded material could reach a stream; and (b) on compacted skid trails with slopes greater than 20 percent.

Amendments to the Malheur Forest Plan

Amendment 29 (1994)

Amendment 29 amended the Malheur Forest Plan in 1994 to incorporate recommendations for managing and restoring aquatic habitat from the Columbia River Basin Anadromous Fish Habitat Management Policy and Implementation Guide (January 25, 1991). Amendment 29 of the Forest Plan established numeric desired future conditions (DFCs) for aquatic habitat by modifying Forest Plan Standard 5 for MA3B, anadromous riparian areas. Modification included incorporation of numeric DFCs for the following aquatic habitat elements: sediment and substrate, water quality, channel morphology, and riparian vegetation. Numeric DFCs were designed to manage designated habitat elements within their natural ranges of variability on the Forest.

PACFISH (1995)

The Malheur Forest Plan was amended in 1995 by direction of the Regional Forester with the Interim Strategy for Managing Anadromous Fish-Producing Watersheds in Eastern Oregon and Washington,

Idaho, and Portions of California (USDA Forest Service 1995a). PACFISH provided ecosystem-based management strategies designed to arrest the degradation of and begin the restoration of aquatic habitat and riparian areas on the lands administered by the Forest Service and Bureau of Land Management in the above-listed states, specifically in watersheds outside the range of the northern spotted owl that provide habitat for Pacific salmon, MCR steelhead, and sea-run cutthroat trout (anadromous fish). Activities in the Camp Lick planning area fall under direction of PACFISH because the planning area is located within the range of anadromous fish.

PACFISH Riparian Goals

The PACFISH riparian goals establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas, and associated fish habitats. The goals are to maintain or restore:

1. water quality to a degree that provides for stable and productive riparian and aquatic ecosystems;
2. stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed;
3. instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood events;
4. natural timing and variability of the water table elevation in meadows and wetlands;
5. diversity and productivity of native and desired non-native plant communities in riparian zones;
6. riparian vegetation to:
    a) provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;
    b) provide adequate summer and winter thermal regulation within the riparian and aquatic zones;
    c) help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed;
7. riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region; and
8. habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate population that contribute to the viability of riparian-dependent communities.

PACFISH Riparian Habitat Conservation Areas

PACFISH amended the Forest Plan by establishing riparian habitat conservation areas (RHCAs), establishing numeric riparian management objectives (RMOs), and establishing standards and guidelines for managing activities in RHCAs. PACFISH replaced existing direction contained in the Forest Plan except where the Plan provided more protection for anadromous fish habitat. Riparian-dependent resources receive primary emphasis in RHCAs, and management activities are subject to specific standards and guidelines.

RHCAs are differentiated by the following four categories (Table 1). PACFISH establishes default buffers for RHCAs on the Forest (USDA Forest Service 1995a).

Table 1. PACFISH riparian habitat conservation area (RHCA) buffer widths

RHCA category	Description	RHCA buffer width (feet)
1	Fish bearing streams that are either perennial or intermittent	300
2	Non-fish bearing streams that are perennial	150
3	Ponds, lakes, reservoirs, and wetlands >1 acre	150

RHCA category	Description	RHCA buffer width (feet)
4	Non-fish bearing streams that are intermittent, ponds, lakes, or wetlands <1 acre	100

Buffer widths for PACFISH RHCAs are based on slope distances. When the Malheur National Forest created the Forest geographic information systems (GIS) cover for RHCAs, RHCAs were delineated using an average slope of 35 percent which resulted in a buffer width of 283 feet for category 1 RHCAs, 142 feet for category 2 RHCAs, and 93 feet for category 4 RHCAs. These widths are used for planning purposes only. During layout of unit boundaries, RHCA buffer widths would be based on actual slope distances. Where slopes are greater than 35 percent actual RHCA buffer widths would be narrower than displayed by the Forest's RHCA GIS cover and where slopes are less than 35 percent actual RHCA buffer widths would be greater than the Forest's RHCA GIS cover. Therefore, there would likely be slight differences in acreages between planning documents and actual implementation of projects for RHCAs and units adjacent to RHCAs.

Within the planning area the fish-bearing portions of Whiskey, Cottonwood, Lick, West Fork Lick, Cougar, Trail, Camp, East Fork Camp, Shoberg, and Coxie creeks are protected by 600-foot wide (total width, 300 feet on each side) RHCAs (as defined within PACFISH). RHCA widths along other streams in the planning area vary depending on whether streamflow is perennial or intermittent.

PACFISH Standards and Guidelines

PACFISH standards and guidelines include:

- Prohibit timber harvest, including fuelwood cutting, in RHCAs except where:
    - Catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, [then] allow salvage and fuelwood cutting in RHCAs only where present and future woody debris needs are met, where cutting would not retard or prevent attainment of other RMOs, [and] where adverse effects on listed anadromous fish can be avoided. For watersheds with listed salmon or designated critical habitat, complete Watershed Analysis prior to cutting in RHCAs (PACFISH standard TM-1a).
    - Apply silvicultural practices for RHCAs to acquire desired vegetation characteristics where needed to attain RMOs. Apply silvicultural practices in a manner that does not retard attainment of RMOs and that avoids adverse effects on listed anadromous fish (PACFISH standard TM-1b).
- For each existing or planned road, meet RMOs and avoid adverse effects on listed anadromous fish by minimizing road and landing locations in RHCAs (PACFISH standard RF-2b).
- For each existing or planned road, meet RMOs and avoid adverse effects on listed anadromous fish by avoiding sidecasting[2] of soils or snow. Sidecasting of road material is prohibited on road segments within or abutting RHCAs in watersheds containing designated critical habitat for listed anadromous fish (PACFISH standard RF-2f).
- Determine the influence of each road on RMOs. Meet RMOs and avoid adverse effects on listed anadromous fish by:
    - Reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or that have been shown to be less effective than designed for

[2] The pushing of excavated material off the edge of the road.

controlling sediment delivery, or retard attainment of RMOs, or do not protect designated critical habitat for listed anadromous fish from increased sedimentation (PACFISH standard RF-3a).
    - Prioritizing reconstruction based on the current and potential damage to listed anadromous fish and their designated critical habitat, the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of RHCAs (PACFISH standard RF-3b).
    - Closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to listed anadromous fish and their designated critical habitat, and the ecological value of the riparian resources affected (PACFISH standard RF-3c).
- Trees may be felled in RHCAs when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives (PACFISH standard RA-2).
- Prohibit storage of fuels and other toxicants within RHCAs. Prohibit refueling within RHCAs unless there are no other alternatives. Refueling sites within a RHCA must be approved by the Forest Service and have an approved spill containment plan (PACFISH standard RA-4).
- Locate water drafting sites to avoid adverse effects to listed anadromous fish and instream flows, and in a manner that does not retard or prevent attainment of RMOs (PACFISH standard RA-5).
- Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of RMOs, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function, listed anadromous fish, or designated critical habitat (PACFISH standard FM-1).
- Design prescribed burn projects and prescriptions to contribute to the attainment of RMOs (PACFISH standard FM-4).

PACFISH Key Watersheds

The intent of designating key watersheds is to provide a pattern of protection across the landscape where habitat for anadromous fish would receive special attention and treatment. Priority within these watersheds would be to protect or restore habitat for listed stocks, stocks of special interest or concern, or salmonid assemblages of critical value for productivity or biodiversity. Criteria considered to designate key watersheds are:

1. Watersheds with stocks listed pursuant to the ESA, stocks identified in the 1991 American Fisheries Society report as “at risk,” or subsequent scientific stock status reviews;
2. Watersheds that contain excellent habitat for mixed salmonid assemblages; or,
3. Degraded watersheds with a high restoration potential.

The Camp Creek-Middle Fork John Day River watershed meets the criteria for a PACFISH key watershed.

Resource Elements, Indicators, and Measures

The measurement indicators detailed in Table 2, and described above, are used for assessing impacts to aquatic species. See Table 4 for a more detailed description of the primary habitat elements.

Table 2. Resource elements, indicators and measures for assessing effects to aquatic species

Resource element	Resource indicator	Measure (quantify if possible)	Source
Aquatic habitat function and health	Primary habitat element – pool frequency	Pools per mile	PACFISH; Forest Plan Amendment 29
Aquatic habitat function and health	Primary habitat element – water temperature and stream shading	7 day mean maximum temperature (degrees Celsius and Fahrenheit) and percent shade	PACFISH; Forest Plan Amendment 29
Aquatic habitat function and health	Primary habitat element – embeddedness and fine sediment	Percentage of streambed composed of fine sediment	PACFISH; Forest Plan Amendment 29
Aquatic habitat function and health	Primary habitat element – width to depth ratio	Mean wetted width divided by depth	PACFISH; Forest Plan Amendment 29
Aquatic habitat function and health	Primary habitat element – bank stability	Percent stability	PACFISH; Forest Plan Amendment 29
Aquatic habitat function and health	Primary habitat element – large woody debris	Pieces per mile in forested systems	PACFISH; Forest Plan Amendment 29
Proposed, endangered, threatened, and sensitive species	Effects to species	Effects determination	Endangered Species Act; Region 6 Regional Forester's special status species list (USDA Forest Service 2015); Malheur Forest Plan (USDA Forest Service 1990, Forest-wide standards 62-67, pages IV-32 to IV-33)
Management indicator species – riparian habitat	Effects to species	Effects determination	Malheur Forest Plan (USDA Forest Service 1990, Fish and Wildlife Objectives, pages IV-17 to IV-18; Forest-wide standard 61, page IV-32)

Affected Environment

General History

Lands within the planning area have been subjected to a variety of land-use activities. Practices have included past silviculture treatments, fire suppression, prescribed fire, road construction, railroad construction (See Camp Lick Heritage Report), logging (the planning area was a prime location for timber harvest on public lands after World War II.), and livestock grazing on public and private land, in addition to wildfires throughout the landscape (Camp Creek Watershed Restoration Action Plan, USDA Forest Service 2011). These activities have reduced aquatic species habitat quality and the complexity of streams within the planning area.

Prior to Euro-American settlement in the valley, the native forest was predominantly ponderosa pine (*Pinus ponderosa*) with a fire regime of low severity fires and 10 to 35 year recurrence intervals (Agee 1993, McIver and Ottmar 2006). As a result of fire suppression, grand fir and Douglas-fir trees are becoming more common. Also, because of the fuel build up along the forest floor and logging practices, the fire regime has been altered from one of frequent low-severity fire to infrequent high-severity fires (McIver and Ottmar 2006). The planning area has not experienced a wildfire larger than 15 acres since

1910 because of active fire suppression. As a result, stand densities have been impacted. The forest has become denser, and in some areas where fire historically played a part in managing conifers encroachment, conifers have started to grow densely in the riparian area. Conifer encroachment consists most commonly of lodgepole encroachment into meadows.

Existing Condition

Legacy effects from past timber harvest, grazing, and road construction, have caused channel widening and straightening and have reduced stream shading. These practices have also impacted water temperature, habitat complexity, pool formation, and instream habitat availability. Old railroad berms in the planning area along Camp Creek impact the channel's ability to meander and disconnect the stream from its floodplain. In some areas, roads have separated potential future large wood from the stream due to road placement in the riparian area. Roads in the planning area that occur within 100 feet of streams or that cross streams, commonly impact fish and fish habitat more than roads located in the uplands. A high percentage of roads in riparian habitat conservation areas (RHCAs) in the planning area are native surface roads, which contribute fine sediment to streams that adversely affect aquatic habitats. There are approximately 400 miles of open and closed roads in the planning area, which is approximately 60 square miles, making the road density approximately 6 miles per square mile.

There are approximately 300 miles of roads in the planning area that impact streams due to proximity (within 100 feet or less). These conditions reduce availability of subsurface cool water storage and have caused streams to become disconnected from floodplains. Some of these roads are adversely impacting all six of the primary habitat elements (see description below). Fine sediment is also a concern for roads that are hydrologically connected to disturbed areas.

Road-stream crossings have impacted local stream channels and water quality. Some crossings were poorly designed with improperly sized culverts and misalignment relative to the natural stream channel. Other culverts have become fish passage barriers that limit the distribution of fish, and include:

- A culvert on a tributary to Big Rock Creek (Appendix B, Figure 1416)
- An exposed pipe on Eagle Creek (Appendix B, Figure 17-19)
- Two culverts on Eagle Creek, on National Forest System (NFS) Road 3600189 (Appendix B, Figure 20-23) and NFS Road 3650478 (Appendix B, Figure 24)
- Two culverts on Coxie Creek, NFS Road 3645273 (Appendix B, Figure 25-28 and Figure 29-30)
- A culvert on a tributary to Coxie Creek on NFS Road 3600155 (Appendix B, Figure 31-32)
- A culvert on a tributary to Cottonwood Creek (Appendix B, Figure 46-49)
- Two culverts on Whiskey Creek (Appendix B, Figure 51-52)

Past grazing management practices (prior to the 1990 Malheur Forest Plan) impacted existing aquatic habitat and water quality due to reductions in shade and bank-stabilizing wetland vegetation, stream bank alteration, and increases in width to depth ratios and fine sediment levels. These impacts were exacerbated within areas that had been disturbed by railroad grades and logging. Improved management practices, on both private land and Forest Service land, have resulted in improved aquatic conditions. Restoration activities such as fence building for better range management, and adding large wood to streams has helped with these improvements. Observations at sites that have had large wood added to the stream, such as Coxie Creek and Big Rock Creek, show less impact from ungulate damage (Appendix B, Figure 42-43 and Figure 44-45). Locations with instream wood limited cattle access to the stream and had greater bank stability than locations that lacked instream wood and riparian hardwoods.

Recreation has also impacted streams due to road development providing increased access to the planning area for hunting, fishing, hiking, firewood cutting, and dispersed camping. In the fall, deer and elk hunting are popular recreation activities within much of the planning area. Dispersed campsites have

impacts to aquatic habitat, and use of these sites varies throughout the year, with the majority of sites showing heaviest use during the fall hunting season.

Primary habitat elements

Important aquatic habitat elements as defined by PACFISH and Forest Plan Amendment 29 include: 1) pool frequency, 2) water temperature and stream shading, 3) embeddedness and fine sediment, 4) width to depth ratio, 5) bank stability and 6) large woody debris. These habitat elements are important in maintaining aquatic habitat function and health and are linked to physical and biological processes within the watershed.

Table 3. Existing condition from most recent Pacific Northwest Region (R6) stream surveys for five primary habitat elements used for comparison of alternatives (Values in bold font are meeting fish habitat objectives)

Stream name	Survey year	Pool frequency (pools per mile)	Water temperature (7 day mean maximum)	% Shade[3]	Embeddedness / fine sediment (<2 millimeters)	Wetted W:D ratio	Average bank stability (% stable)	Forest type[4]	Coarse wood [5]	Large wood per mile [6]
Big Rock Creek reach 1	2014	28	64.53 ^{0}F	**58**	52.5	11.3	**99**	MC	65	24
Big Rock Creek reach 2	2014	8	-	**96**	46.5	11.67	**99**	MC	31	23
Camp Creek reach 1	2016	32.88	69.5 ^{0}F	22	18.85	21.32	**95.9**	CP	51	13
Camp Creek reach 2	Private land	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Camp Creek reach 3	2016	31.82	67.5 ^{0}F[1]	8	18.65	25.9	**98.67**	CP	22	10
Camp Creek reach 4	2016	34.23	63.4 ^{0}F[1]	48.44	1.4	23.4	**99.75**	MC	30	16
Camp Creek reach 5	2016	25.53	67.6 ^{0}F[1]	22	5.05	23.3	**98.57**	MC	17	9
Camp Creek reach 6	2016	31.9	62.8 ^{0}F[1]	**61.75**	13.7	20.1	**99.6**	CP	25	**35**
Camp Creek reach 7	2016	31	66.7 ^{0}F[1]	**46.33**	36.85	14.08	**98.41**	CP	45	**25**
Camp Creek reach 8	2016	69.57	68.2 ^{0}F[1]	35.67	38.05	14.02	**99.48**	CP	68	**67**
Camp Creek reach 9	2016	37.58	63.2 ^{0}F[1]	18.5	18.25	15.27	**96.74**	CL	0	69
Camp Creek reach 10	2016	18.82	**59.7 ^{0}F[1]**	**65.33**	58.15	12.60	88.9	CL	0	**180**
Camp Creek reach 11	2016	18.84	**58.7 ^{0}F[1]**	**80**	91.85	13.39	67.85	MC	23	25
Cougar Creek reach 1	2014	22	74.55 ^{0}F	**71**	34.5	15.34	**99**	MC	14	70

Stream name	Survey year	Pool frequency (pools per mile)	Water temperature (7 day mean maximum)	% Shade[3]	Embeddedness / fine sediment (<2 millimeters)	Wetted W:D ratio	Average bank stability (% stable)	Forest type[4]	Coarse wood [5]	Large wood per mile [6]
Cougar Creek reach 2	2014	5	**60.8 ^{0}F[2]**	**91**	34	**7.6**	**99**	MC	1	8
Cottonwood Creek reach 1	2016	46.49	67.82^{0}F	**79.2**	**2.55**	20.89	**100**	CL	0	39
Cottonwood Creek reach 2	2016	17	-	34.67	32.6	13.13	**99.5**	CP	6.2	5
Cottonwood Creek reach 3	2016	19	-	**95.5**	24.9	12.66	**100**	MC	15.6	12
Cottonwood Creek reach 4	2016	2.4	-	**93.67**	51.8	12.06	**100**	MC	17.4	14
Coxie Creek reach 1	2016	5.58	-	**56**	42	10.79	**94.92**	MC	6.75	17
Coxie Creek reach 2	2016	-	-	**75**	100	-	**95.29**	MC	36	33
Eagle Creek reach 1	2014	11	68 ^{0}F[2]	**75**	40.5	11	**99**	MC	4	18
Eagle Creek reach 2	2014	1	71 ^{0}F[2]	**74**	49	20	**99**	MC	20	31
East Fork Camp Creek reach 1	2016	39.56	55.11^{0}F	**50.25**	92.3	**8.47**	84.07	MC	37.4	31
East Fork Camp reach 2	2016	10.48		49	24.75	10.56	75.13	MC	64.5	40
Little Trail Creek reach 1	2014	6.67	62.67 ^{0}F	**81.5**	71.5	13.2	**96**	MC	77	42
Lick Creek reach 1	2016	19.62	**60.45^{0}F**	35.6	**18.2**	21.12	**96**	MC	34.1	2
Lick Creek reach 2	2016	20.49	-	26.5	**17.7**	16.03	**95.66**	MC	17.9	2
Lick Creek reach 3	2016	8.7	-	46	21.3	12.13	**99.59**	MC	23	7
Shoberg Creek reach 1	2014	61	70.14 ^{0}F	**70**	36	13.69	**99**	MC	21	7
Shoberg Creek reach 2	2014	45	68 ^{0}F[2]	**80**	43	16.29	**99**	MC	30	21
Sulphur Creek	1994	57.7	**-**	**-**	**-**	-	**-**	MC	2	73
Trail Creek reach 1	2014	7	**59 ^{0}F[2]**	**83**	**20**	10.85	**99**	MC	20	5

Stream name	Survey year	Pool frequency (pools per mile)	Water temperature (7 day mean maximum)	% Shade[3]	Embeddedness / fine sediment (<2 millimeters)	Wetted W:D ratio	Average bank stability (% stable)	Forest type[4]	Coarse wood [5]	Large wood per mile [6]
West Fork Lick Creek reach 1	2016	29.41	**58.33^{0}F**	**55.17**	25.4	14.66	**95**	MC	38	38
West Fork Lick Creek reach 2	2016	45.6	-	**79.4**	36	13.29	**97**	MC	22	37
West Fork Lick Creek reach 3	2016	66.67		**87**	**17.9**	12.5	**99**	MC	30	60
Whiskey Creek reach 1	2014	8	64.4 ^{0}F[2]	**43**	26	10	**99**	CP	0	0
Whiskey Creek reach 2	2014	2	71.6 ^{0}F[2]	**90**	31	**5.87**	**100**	CP	4	1

1. All these temperatures are from a 2004 survey, the 2016 data has not yet been processed.
2. Maximum temperature for the reach is recorded here, no 7 day mean average temperature data is available.
3. Shade for the month of July is reported here.
4. Forest type: MC: mixed conifer, CP: ponderosa pine, CL: lodgepole pine, MHW: hardwood/meadow complexes).
5. Coarse wood for PC and MC is >6 inch diameter and ≥ 20 feet long. Coarse wood for CL is < 6 inches in diameter.
6. Large wood for CP and MC is ≥12 inch diameter and ≥35 feet or 1.5 times bankfull width. For CL it is ≥ 6 inches in diameter and ≥18 feet long or 1.5 times bankfull.

Table 4. PACFISH riparian management objectives and Forest Plan standards for fish habitat criteria

Habitat feature	Riparian management objectives	Amendment 29
Pool frequency [1] *Wetted width in feet* *Number of pools per mile*	 10 20 25 50 75 100 125 150 200 96 56 47 26 23 18 14 12 9	 <10 >10-20 >20-25 >25-50 75-132 38-66 30-53 15-26
Water temperature (all systems)	Compliance with state water quality standards, or maximum <68 degrees Fahrenheit / 20 degress Celsius	N/A
Large woody debris (pieces per mile in forested systems) [2]	East of Cascade Crest in Oregon, Washington, and Idaho, >20 pieces >12 inch diameter, >35 foot length	*Ponderosa Pine ecosystem* – 20-70 pieces ≥12 inch diameter and 20% >20 inches in diameter and ≥35 feet long or 1.5 times bankfull width. *Mixed Conifer ecosystem* – 80-120 pieces ≥12 inch diameter and 20% >20 inches in diameter and ≥35 feet long or 1.5 times bankfull width. *Lodgepole Pine ecosystem* – 100-350 pieces ≥6 inch diameter and 10% >12 inches in diameter and ≥18 feet long or 1.5 times bankfull width.
Bank stability [2]	>80% stable	>90% stable
Lower bank angle (undercut banks) non-forested system[3]	>75% of banks with <90^{o} angle	50-75% undercut (with less than 2% gradient)
Wetted width / depth ratio[1]	<10 (mean wetted width divided by depth)	<10
Embeddedness[2]	N/A	≤20
Percent shade / canopy closure[2]	N/A	*Ponderosa pine ecosystem* – 40-55% *Mixed conifer ecosystem* – 50-65% *Lodgepole pine ecosystem* – 60-75% *Hardwood/meadow complexes* – 80%

The standard with the more stringent condition or objective is what is followed.
1. The standards are the same
2. Amendment 29 is followed
3. The PACFISH riparian management objective is followed.

Pool Frequency

Pool frequency is a gage of aquatic habitat diversity, and is an indicator of the degree to which streams are capable of supporting a varied and complex community of fish species. Pools are important for providing rearing habitat for juvenile fish and cool-water refuge areas for adult fish during periods of low flow and elevated temperatures. Deep pools provide important habitat for adult Mid-Columbia River (MCR) steelhead which spawn in streams located in the planning area. Pool frequency is also an indicator of the function of physical processes such as scour and deposition.

Stream surveys indicate that pool frequency objectives are not being meet in any of the stream reaches that we have data for (See Table 3 and Appendix A and Table 23 PACFISH/INFISH[3] Biological Opinion (PIBO) data). Pool spacing is higher for reaches compared with potential channel types in the planning area, and there is an overall deficit in quality pools. This indicates a loss of pool habitat and general hydrological function as a result of past management activities, especially riparian logging and channel modification during railroad logging and road building.

Current restoration efforts in Camp Creek, which include the addition of large wood and creation of beaver dam analogs (Appendix B, Figure 53-53) along with beaver activity (Appendix B, Figure 57-56) in other areas of the project, are contributing to an increase in the number of pools in the planning area. However, further work is needed to reach desired conditions for the certain reaches of stream in the area.

Water Temperature and Stream Shading

Water temperature influences the metabolism, behavior, and health of fish and other aquatic organisms. Fish can survive at temperatures near extremes of suitable temperature ranges; however, growth is reduced at low temperatures because all metabolic processes are slowed. At the opposite extreme, growth is reduced at high temperatures because most or all energy from food must be used for maintenance needs.

Mean maximum water temperatures are above the suitable range for salmonid species present during summer months in the planning area in all of the stream reaches that we have data for (Table 3) except for Camp Creek reach 10, Camp Creek reach 11, Cougar Creek reach 2, Lick Creek reach 1, Trail Creek reach 1, and West Fork Lick Creek reach 1. This data may also be used to extrapolate water temperatures both downstream and upstream of temperature sites. The Forest Plan standard for water temperature is for no measurable increase in maximum water temperature. Amendment 29 states no instantaneous reading at any given time above 68 degrees Fahrenheit, and the PACFISH riparian management objective (RMO) is for maximum water temperatures below 64 degrees Fahrenheit within migration and rearing habitat and below 60 degrees Fahrenheit within spawning habitats. PACFISH is a standards for fish habitat and may not be consistent with Total Maximum Daily Load (TMDL). For Comparison with TMDL see the Camp Lick Watershed Report.

The average 7-day maximum stream temperature across the planning area, where data is available, ranges from 55.17 to 71.6 degrees Fahrenheit. The temperature metrics by stream reach are summarized in Table 3 and the Camp Lick Watershed Report.

Riparian stream shading is critical in regulating water temperature extremes and providing instream cover against predation. Vegetation along streams in the planning area is highly variable. Most streams have a

[3] INFISH: Decision Notice Finding No Significant Impact and Forest Plan amendment for incorporation of the interim strategies for managing fish-producing watersheds of Oregon and Washington, Idaho, western Montana, and portions of Nevada (USDA Forest Service 1995c).

patchy distribution of forest and non-forest open vegetation types. Many of the stream reaches have high densities of conifers located in the RHCA, and have low densities of hardwoods or large conifers. The presence of stringer meadows in the planning area, instead of forest vegetation, contributes to high stream temperatures only when riparian hardwood vegetation is inadequate or degraded, channel morphology is out of balance (over-widened), or floodplain connectivity is lost (incised channel), increasing solar radiation and decreasing groundwater exchange and recharge.

Stream surveys indicate that shade standards/canopy cover (Table 3) are being met in 25 of the 37 stream reaches that were surveyed. Those reaches are: Big Rock reach 1 and 2, Camp Creek reaches 7, 6, 10 and 11, Cougar Creek reaches 1 and 2, Cottonwood Creek reaches 1, 3, and 4, Coxie Creek reaches 1 and 2, Eagle Creek reaches 1 and 2, East Fork Camp Creek reach 1, Little Trail Creek, Shoberg Creek reaches 1 and 2, West Fork Lick Creek reach 1, 2 and 3, and Whiskey Creek reaches 1 and 2. The shade metrics by stream reach are summarized in Table 3 and Appendix A of this report.

Large Woody Debris

Large woody debris (LWD) and coarse woody debris (CWD) play an important role in forested stream reaches and maintaining beaver created meadows (Burchsted 2010) by dissipating stream energy, trapping sediment, trapping riparian hardwood and hydric plant seeds, and providing suitable microclimates for seed germination (Osei et al. 2015). Woody debris provides stream grade stabilization, initiates streambed aggradation and channel braiding, and forms pools (Polvi and Wohl 2013, Cluer and Thorne 2014), all of which increase habitat complexity.

Riparian forests, especially individual trees that are within half to three quarters tree length of the stream channel, produce LWD that is recruited into a stream where it creates critical habitat features for aquatic species. Forest Plan Amendment 29 specifies a range in the number of pieces of LWD to be maintained for each mile of stream in certain ecotypes. Standards for LWD are located in Table 4 and Appendix A of this report.

Prior to the PACFISH amendment (USDA Forest Service 1995a) to the Forest Plan, timber was harvested from areas adjacent to streams in the planning area. In the past, firewood was also taken from streamside areas. See the Existing Condition section for more information on past silvicultural activities within riparian areas. In extreme cases, removal of floodplain timber coupled with large increases in peak flows and large increases in channel width resulted in destabilization of instream pieces and subsequent transport downstream, thus resulting in a decrease in LWD. Stream surveys indicate that lowest LWD standards are being meet in Camp Creek reaches 6, 7, 8, and 10. Please note that although these streams may be meeting the minimum standard for wood, they do not meet the optimal standard and the desired condition for the stream. All other surveyed stream are not meeting LWD objectives (See Table 3, and please note that surveys are not available for all the streams in the planning area).

It is also important to note that the large woody debris surveys require at least part of the wood to be within bankfull for the piece of wood to be counted during the stream surveys (USDA Forest Service 2015c). There have been multiple restoration projects completed within the Camp Lick planning area that have resulted in large wood additions to the stream. Between 2012 and 2014 wood was added to parts of Camp Creek, Big Rock Creek, Lick Creek, Shoberg Creek, West Fork Lick Creek, Little Trail Creek, and Cottonwood Creek. In 2016, 88 large wood and 56 small or coarse wood jams were placed within Camp Creek reaches 8 and 9. Some large wood additions done in Coxie Creek (reaches 1 and 2) resulted in channel spanning logs above bankfull, and are future large wood, not counted as current large wood by the stream surveys. These channel spanning logs provide cover, contribute to channel and habitat complexity, and provide food for aquatic insects. Field observations also indicate that large wood can help protect stream banks and springs from ungulate damage, enhancing stream bank stability. Locations with

large wood in Coxie Creek showed less ungulate damage when compared with areas with less large wood (See Aquatic Resources Report, Appendix B, Figure 42-43).

Embeddedness and Fine Sediment

Composition of the stream substrate is an important feature of aquatic habitat. Cobble and gravel substrates provide habitat for macroinvertebrates as well as eggs and early life stages of numerous fish species. Macroinvertebrates represent a substantial portion of the diet available to fish. Filling of interstitial spaces (i.e., the gaps between rocks on the stream bottom) with fine sediment (particles less than 2 millimeters in size) eliminates habitat for many macroinvertebrates. Fish eggs, early life stages, and winter habitat for juvenile salmonids can also be buried and smothered when interstitial spaces are embedded with fine sediment. However, fine sediment is part of the bedload of the stream, and is utilized by some aquatic organisms such mussels and lamprey, which burrow in fine sediment. Thus, there is a balance of how much fine sediment the organisms that inhabit a stream can handle.

Stream surveys indicate that substrate embeddedness and fine sediment objectives (less than 20 percent fine sediment) are not being met in Big Rock Creek reaches 1 and 2; Camp Creek reaches 7, 8, 10, and 11; Cougar Creek reaches 1 and 2; Cottonwood Creek reaches 2 and 3; Coxie Creek reaches 1 and 2; Eagle Creek reaches 1 and 2; East Fork Camp Creek reaches 1 and 2; Little Trail Creek reach 1; Lick Creek reach 3; Shoberg Creek reaches 1 and 2;West Fork Lick Creek reaches 1 and 2; and Whiskey Creek reaches 1 and 2 (Table 3).

Likely sources for fine sediment are activities in the riparian area and the areas upslope of the stream in streams that have steep slopes. Activities that may contribute fine sediment to the riparian areas include: channel modification from railroad logging, severe wildfire, channel erosion, livestock grazing (especially past grazing), and roads. As mentioned previously, fine sediment is utilized by some aquatic organisms and thus is needed in streams in specific locations. Fine sediment also provides the medium for development of nutrient rich soils. However, fine sediment is not good when deposition occurs on pool tails outs or fills pools, this indicates altered hydrology and channel morphology, since fine sediment would normally drop out onto the floodplain or be trapped behind large wood or boulders. Thus, things like instream large wood and beaver dams that help build banks and the stream bed, or that capture pockets of fines sediment instead are needed. Other things that aid in controlling the amount of fine sediment entering a stream are road and culvert maintenance.

Although no stream survey data was available for Pepper Creek, a tributary to Camp Creek, field observations have shown that fine sediment is entering the stream at location where a culvert has been plugged and the road is now being washed out (Aquatic Resources Report, Appendix B, Figure 33-36 Pepper Creek). A proposal to fix the plugged pipe on NFS Road 3660565 has been made to address this issue (maintenance of the road is listed in the project PDCs). Field observations on Sulphur Creek, another tributary to Camp Creek, found an old road crossing (NFS Road 3600268) where a head cut has formed and is a likely source of fine sediment to the stream (Aquatic Resources Report, Appendix B Figure 37-41). Further upstream of Sulphur Creek there is a plugged culvert inlet with a perched outlet, the plugged culvert is causing flow to go over the road and wash down the stream off the road. This is likely adding sediment to the stream and is located on a proposed haul route road, NFS Road 3660321. Pepper Creek is not identified as a fish bearing stream, however it flows into Camp Creek which is both fish bearing and MCR steelhead critical habitat, and Sulphur Creek is a fish bearing stream. Project design criteria (PDCs) were developed to address issues like the ones mentioned for Sulphur creek (See Camp Lick PEA Appendix C – Project Design Criteria).

Width to Depth Ratio

Forest Plan standards for width to depth ratios are based on wetted width and depth. A large wetted width to depth ratio indicates a wide and shallow stream channel. Wide and shallow streams are prone to increases in stream temperatures due to high surface area to volume ratio and provide little habitat for fish, due to the lack of water depth. This stage within the stream channel evolution model is associated with poor biological and physical habitat complexity (Cluer and Thorne 2014).

Stream surveys indicate that objectives for wetted width to depth ratios are being met in: Cougar Creek reach 2; East Fork Camp Creek reach 1; and Whiskey Creek reach 2, and that they are not being meet in any of the other streams surveyed (Table 3).

Many of the streams in this planning area have roads on either or both sides of the stream. Close proximity of roads to the stream focuses flows within the stream channel, over-widening/incising the stream channel. Legacy effects from timber harvest, and livestock grazing also contributed to the channel over widening and incising. Camp Creek also has a number of railroad berms within the streams' floodplain that are effecting the stream ability to meander, which also focuses flows in the stream channel and contributes to channel incision and over-widening.

Perched culverts can lead to stream down-cutting and incising; and undersized culverts can further the impacts of this by concentrating and increasing flow. A tributary to Cottonwood Creek in particular has a head cut located near a perched and undersized culvert located on NFS Road 1800785 (Appendix B, Figure 50) which is also impacting the culvert below (Appendix B, Figure 46-49); as does a tributary to Whiskey Creek on NFS Road 3600517 (Appendix B Figure 51-52).

Bank Stability

Channel types differ in their sensitivity to management activities due to differences in bank erosion potential and the influence of streamside vegetation on bank stability. Stream surveys indicate that bank stability objectives are not being met in Camp Creek reaches 10 and 11 and East Fork Camp Creek reaches 1 and 2, and unstable banks have been observed in multiple streams, with a head cut identified in a tributary to Whiskey Creek in reach 1. Furthermore, in some streams bank stability is being impacted by a lack of instream roughness, and floodplain connectivity preventing banks from forming so that the stream banks are dominated by cobble on both sides of the stream. Thus, pockets of finer sediment which can catch hardwood seeds, and build up to form banks which then can form beneficial habitat such as undercuts banks, cannot form in these locations; and although cobble banks are stable because large substrate is harder to erode, some stream are not functioning the way they would have historically.

Bank instability is more prevalent in areas that lack riparian hardwoods, as well as in areas of heavy cattle use.

Existing Condition Compared to Desired Condition

Fish habitat in the analysis area generally does not meet Forest Plan DFCs/RMOs for pool frequency, LWD, sediment, temperature, and width to depth ratio (Table 3). The condition of important habitat elements including low pool frequency, high water temperatures, reduced LWD frequency, high fine sediment levels, and moderately high width to depth ratios indicate reduced fish habitat quality as a result of past management activities. Although bank stability does meet the RMOs in general, specific locations where bank instability is occurring are not in the appropriate locations. Areas of bank instability often occur on the outside banks of stream meanders. Where stream channels have been straightened, bank instability is occurring on both sides of the stream channel (mostly related to roads and past management activities) due to excessive stream energy and lack of energy dissipation in the form of LWD, sinuosity,

and floodplain roughness. Most streams in the analysis area are in a highly altered state, with conditions of important habitat elements strongly limiting quality of fish habitat.

Additional metrics based on Amendment 29 desired future condition (DFC), PACFISH RMOs, and National Marine Fisheries Service (NMFS) and Fish and Wildlife Service (FWS) Matrix of Pathways and Indicators are included within the Aquatic Resources Report, Appendix A.-Desired conditions for all habitat elements, excluding coarse woody debris, are driven by law, regulation and policy. See Regulatory Framework for more details on desired conditions.

Coarse Woody Debris Desired condition

Standards for desired coarse woody debris are not listed in the riparian management objectives listed in the legal framework, amendment 29 RMOs. However, the benefits of coarse woody debris along with large woody debris as previously stated in the large wood existing condition section above are well documented (Fox and Bolton 2007). Woody debris provides stream grade stabilization, initiates streambed aggradation and channel braiding, and forms pools (Polvi and Wohl 2013, Cluer and Thorne 2014), all of which increase habitat complexity. For this project area coarse woody debris desired condition standards are derived from research done by Fox and Bolton, using data from the northern Blue Mountains, managing for the stream to meet 75 percent of the recommended coarse wood (2007). Desired conditions for coarse woody debris are 467 pieces of coarse wood per mile per reach, within the floodplain, or a number of coarse woody debris determined by aquatic specialist.

Both the large and coarse woody debris desired conditions must be meet prior to the consideration of commercial harvest in the RHCA. The number of pieces of coarse woody debris needed to meet this desired condition for reaches considered for commercial harvest in the outer portion of the RHCA are listed in a table below.

Table 5. Large and coarse woody debris desired conditions for ecological riparian treatments

Stream treatment reach	Reach Length (Mi)	Forest Type	Existing Large Wood (per mile)	LW Standard	LWD per mile needed to meet objectives	Existing Coarse Wood (per Mile)	CW standard (per mile) within the riparian area that needs to be meet	CWD added to reach to meet objectives
Big Rock Creek Reach 1	0.787	MC	24	80-120 L	96	65	467	402
Big Rock Creek Reach 2	0.437	MC	23	80-120 L	97	31	467	436
Camp Creek Reach 3	0.819	CP	10	20-70 L	60	22	467	445
Camp Creek Reach 4	2.954	MC	16	80-120 L	104	30	467	437
Camp Creek Reach 5	1.731	MC	9	80-120 L	111	17	467	450
Camp Creek Reach 8	1.555	CP	67	20-70 L	3	68	467	399
Camp Creek Reach 10	1.963	CL	30	100-350 S,L	170	150	467	317
Cougar Creek Reach 1	2.21	MC	70	80-120 L	50	14	467	453
Cougar Creek Reach 2	0.88	MC	8	80-120 L	112	1	467	466
Coxie Creek Reach 1	1.895	MC	17	80-120 L	103	7	467	460
Eagle Creek Reach 1	0.725	MC	18	80-120 L	102	4	467	463

Stream treatment reach	Reach Length (Mi)	Forest Type	Existing Large Wood (per mile)	LW Standard	LWD per mile needed to meet objectives	Existing Coarse Wood (per Mile)	CW standard (per mile) within the riparian area that needs to be meet	CWD added to reach to meet objectives
Eagle Creek Reach 2	0.833	MC	31	80-120 L	89	20	467	447
East Fork Camp Creek Reach 1	0.75	MC	31	80-120 L	83	37	467	430
East Fork Camp Reach 2	1.14	MC	40	80-120 L	80	65	467	403
Little Trail Creek Reach 1	1.5	MC	42	80-120 L	78	77	467	390
Lick Creek Reach 1	2.4	MC	2	80-120 L	118	34	467	433
Lick Creek Reach 2	2.9	MC	2	80-120 L	118	18	467	449
Lick Creek Reach 3	1.2	MC	7	80-120 L	113	23	467	444
Shoberg Creek Reach 1	0.611	MC	7	80-120 L	113	21	467	446
Shoberg Creek Reach 2	1.189	MC	21	80-120 L	99	30	467	437
Sulfur Creek Reach 1	1.23	MC	**73**	80-120 L	47	2	467	465
Trail Creek Reach 1	1.96	MC	5	80-120 L	115	20	467	447
West Fork Lick Creek Reach 1	1.7	MC	38	80-120 L	82	38	467	429
West Fork Lick Creek Reach 2	2.2	MC	37	80-120 L	83	22	467	445
West Fork Lick Creek Reach 3	0.2	MC	60	80-120 L	60	30	467	437
Whiskey Creek Reach 1	1.26	CP	0	20-70 L	70	0	467	467

Aquatic Species

Threatened, Endangered, and Sensitive Species (TES)

An endangered species is an animal or plant species listed under the Endangered Species Act (ESA) that is in danger of extinction throughout all or a significant portion of its range. A threatened species is an animal or plant species listed under the ESA likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Threatened species known to inhabit the Malheur National Forest include bull trout and Mid-Columbia River (MCR) steelhead, but only MCR steelhead are currently present in the Camp Lick planning area.

A sensitive species is an animal or plant species identified by the Regional Forester for which species viability is a concern either: 1) because of current or predicted downward trend in population numbers or density, or 2) because of current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Pacific Northwest Region [R6] sensitive).

Management Indicator Species

Management indicator species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate effects of land management activities. Through the MIS concept, the total number of species found within a planning area is reduced to a subset of species that collectively

represent habitats, species, and associated management concerns. MIS are used to assess the maintenance of populations (the ability of a population to sustain itself naturally) and biological diversity (which includes genetic diversity, species diversity, and habitat diversity), and to assess effects on species in public demand.

The Malheur Forest Plan identifies the following aquatic species as management indicator species for healthy stream/riparian habitats: westslope cutthroat trout, redband/rainbow trout, MCR steelhead, and bull trout (USDA Forest Service 1990). The planning area only has redband/rainbow trout and MCR steelhead; of these, only MCR steelhead are also TES. These aquatic MIS were selected to indicate healthy stream and riparian ecosystems across the landscape. Riparian ecosystems occur at the margins of standing and flowing water, including intermittent stream channels, ephemeral ponds, and wetlands. Attributes of a healthy aquatic ecosystem include: cold and clean water; channel substrates; stable stream banks; healthy streamside vegetation; complex channel habitat created by large wood, cobbles, boulders, streamside vegetation, and undercut banks; deep pools; and waterways free of barriers. Healthy riparian areas maintain adequate temperature regulation, nutrient cycles, natural erosion rates, and provide for in stream wood recruitment.

In general, the aquatic MIS have similar stream and riparian ecosystem requirements. However, they do represent a range of minor differences in habitat conditions found and utilized across the Malheur National Forest. As an example, bull trout require slightly colder water when compared to redband trout. Because the habitat requirements for each species are generally similar and often overlap, they were collectively chosen to represent healthy stream and riparian ecosystems. All aquatic MIS on the Blue Mountain Ranger District of the Malheur National Forest are currently listed as threatened or sensitive.

Determining Presence of Species or Habitats

The following sources of information have been reviewed to determine if threatened, endangered, sensitive, or management indicator species and their associated habitats occur within the planning area:

1. Malheur National Forest geographic information system (GIS) database
2. Region 6 Regional Forester's special status species list (7/2015)
3. Oregon Department of Fish and Wildlife (ODFW) stream/fish survey reports
4. Forest Service stream survey reports, Blue Mountain Ranger District, John Day, OR
5. Oregon Natural Heritage Program (ORNHP) database
6. NatureServe database (www.natureserve.org/aboutUs/)

Aquatic Species with Special Management Status Relative to Analysis Area

Mid-Columbia River (MCR) steelhead (threatened, MIS) and interior redband trout (R6 sensitive, MIS) (*Oncorhynchus mykiss gairdneri)* are documented to occur within the planning area in all streams listed in 1. Threatened
2. Regionally sensitive species

Table 7 which displays designated critical habitat for MCR steelhead within the planning area. The Columbia spotted frog (*Rana luteiventris*) (R6 sensitive) is considered present in all subwatersheds of the Malheur National Forest and is known to occur within the analysis area.

The following species have not been found within the planning area nor do they have suitable habitat. The section below provides the rationale for why these species will not be discussed further in this biological evaluation.

- Columbia River Basin bull trout (*Salvelinus confluentus*) (threatened, MIS), have not been observed nor documented in the planning area.
- Westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) (R6 sensitive, MIS), are not present in the planning area nor are existing populations connected to the Middle Fork John Day River.

- The shortface lanx (*Fisherola nuttalli*) (R6 sensitive) is a large freshwater limpet that inhabits cold, unpolluted, medium-sized streams to large rivers approximately 30 to 100 meters wide with fast flowing, well-oxygenated water and cobble-boulder substrate at low elevations. This species is not found in areas with a high abundance of macrophytes or epiphytic algae, or in areas that have been dredged or mined. Streams within the planning area are small in size relative to known species sites. Additionally, the Middle Fork John Day River has warm temperatures, is not considered well-oxygenated, has macrophytic algae growth, and extensive past dredge mining activities. It is unlikely that the species or its habitat is present within the planning area.
- The Columbia clubtail (*Gomphus lynnae)* (R6 sensitive) is a dragonfly that can be found in a variety of river habitats, which can range from sandy or muddy to rocky, shallow rivers with occasional gravelly rapids. Water flow tends to be slow-moving. Larval habitat (river) is the most crucial. Columbia clubtail are found within Oregon over a somewhat short stretch (about 72 miles) of the John Day River, in Wheeler and Grant counties, from Twickenham to Monument; and at a single locality on the Owyhee River near Rome in Malheur County. According to Valley (2010), *G. lynnae* is found over a much longer stretch of the John Day River from Monument to J.S. Burres State Park. Because of the differing stream conditions between the species' type locality and streams within the planning area, as well as the distance from the known populations of this species in the mainstem John Day River, it is unlikely that habitat is found within the planning area.
- California floater (*Anodonta californiensis)* (R6 sensitive) is a freshwater mussel typically found at low elevations, burrowed in soft substrate (mud, sand, or silt) substrates (Cummings and Cordeiro 2011). They are generally found in fairly large streams and lakes only, in relatively slow current (and are essentially limnophilic species, they prefer lakes, still or stagnant water) (Frest and Johannes 1995). The California floater is parasitic in their larval stage and rely on host fish (which generally remain unharmed) for dispersal and reproduction. At a certain size, larvae release themselves from their host, metamorphose, and as adults are filter feeders, that feed on plankton and other suspended matter in the water column (Jespen et al. 2016). *Anodonata* have been found in higher densities in deeper channel units and reaches, indicating the use of flow refugia within pools (Howard and Cuffey 2003). They have been observed in the Middle Fork John Day River at higher densities in channel units greater than 1 meter deep (Hegeman et al. 2014). The streams within the planning area are not very large and have average bankfull depths below 1 meter, and there are no known large lakes in the planning area. Thus, it is unlikely that the species or its habitat is present within the planning area.
- Pacific lamprey *Entosphenus tridentatus*) is a vulnerable species of concern in Oregon (Gunckel et al. 2009; Close et al. 2002) and a Region 6 sensitive species. Pacific lamprey are a primitive eel-like fish that lack jaws, paired fins, or bones. They have a round sucker-like mouth, gill openings, a cartilaginous-skeleton, and no scales. Adult Pacific lampreys are characterized by the presence of three large anterior teeth and many smaller posterior teeth on the oral disc. As ammocoetes (larvae), they are difficult to distinguish from other lampreys (USDI FWS 2016) and spend the majority of the time burrowed in fine sediment (Hardisty and Potter 1971).

  Lampreys are anadromous; they spend 3 to 7 years in streams as larvae and are filter feeders, then they transform into macropthalmia (transformers/juveniles which develop eyes and teeth gradually over several months from July to November) and migrate (winter and early spring) to the ocean where they live as adults for one to three years. At finer scales, ammocoete (larvae) occurrence corresponds positively with low water velocity, pool habitats, and the availability of suitable burrowing habitat (fine substrate) (Roni 2003; Pirtle etal. 2003; Torgersen and Close 2004; Claire et al 2007). Ammocoete downstream movement happens year-round. Due to poor swimming ability, movement is probably driven by flow conditions and velocities (Moursund 2002). As adults lamprey are parasitic and feed on a variety of marine and anadromous fish, then stop feeding and migrate to freshwater between February and June (USDI FWS 2016). A 2005

study by Robinson and Bayer found that radio-tagged lampreys migrated about 11 river kilometers per day (rkm/d) in the John Day River in the summer through fall and that most migration took place at night.

Lampreys are thought to overwinter and remain in freshwater habitat for approximately 1 year before spawning. Radio tagged lampreys in the John Day River have been observed to over-winter under boulders in riffles and glides (Robinson et al. 2002 and Robinson and Bayer 2005). The substrate they were found in was dominantly boulders (greater than 25.4 centimeters) at 30 locations and dominantly cobbles (5.1 to 25.4 centimeters) at one location. Four locations were too deep to observe substrate (Robinson et al. 2002). This is similar to the findings of other studies which show that adult lamprey hold in areas with glides and boulders which serve as cover (Starcevich et al. 2014) and in deep pools and rock revetments (in the Willamette River) Clemens 2011). Over wintering lamprey can shrink in size up to 20 percent. Adult size at the time of migration ranges from about 15 to 25 inches (USDI FWS 2016).

Lamprey spawn in habitat similar to that of salmon: gravel bottomed streams at the upstream end of riffle habitat. Spawning occurs between March and July depending on the location within their range. The degree of homing is unknown, but adult lampreys cue in on pheromones released by ammocoetes, which is thought to aid adult migration and location of spawning locations. After the eggs are deposited and fertilized, the adults typically die within 3 to 36 days after spawning (USDI FWS 2016).Pacific lampreys occur in rivers around the North Pacific Ocean from Japan to Alaska and south to southern Baja California (Renaud 1997). Pacific Lamprey have been documented in the John Day River Basin in the John Day River, North Fork John Day River, South Fork John Day River (Moser and Close 2003), the Middle Fork John Day River (Moser and Close 2003), Camas Creek a tributary to North Fork John Day River, Butte Creek, Flat Creek a tributary to the John Day River, and Granite Creek a tributary to the North Fork John Day River (Close 1998).

Within the John Day River Basin, lamprey distribution is expected to be in mainstem streams up to the Oxbow drainage, including Boulder Creek (Brentton Smith, personal communication 2016). The Camp Creek Watershed Action plan states that it is unclear whether lamprey inhabit Camp Creek. ODFW has observed lamprey near Camp Creek. However, the Forest Service did not find any lamprey present near the confluence of either Camp or Lick creeks while surveying with an electro shocker in October 2016. Substrate at both sites surveyed for lamprey presence were dominated by cobble and boulders, and lacked ideal larval lamprey habitat. This species may have been present historically, however current conditions do not likely support larval life stages. It is unlikely that the species or its habitat is present within the planning area; therefore, this species will not be discussed further in this BE. In the future, there may be an increase in lamprey suitable habitat given the restoration activities being implemented along Camp Creek (particularly more sediment being caught by instream large wood, providing pockets of fine sediment as well as locations with more gravel for spawning).

Western ridged mussel (*Gonidea angulata*) (R6 sensitive). Freshwater mussels, including *G. angulata*, are filter feeders that consume phytoplankton and zooplankton suspended in the water. *G. angulata* is a relatively slow growing and long lived species – perhaps living 20 to 30 years (COSEWIC 2003, Vannote and Minshall 1982). Western ridged mussels have been found within the Middle Fork John Day River, the North Fork John Day River, and the John Day River in Wasco County (Xerces freshwater mussel database 2009).

- Western ridged mussels are associated with low shear stress (shear stress is caused by fast flowing water over substrate) and substrate stability; flow refuges are important determinants of

freshwater mussel survival (Vannote and Minshall 1982). This species is generally associated with constant flow, shallow water (less than 3 feet in depth), and well oxygenated substrates (COSEWIC 2003), and is often present in areas with seasonally turbid streams. *G. angulata* generally occurs at low to mid elevations (Nedeau et al. 2005). Many sites where this species has been found lack dense macrophyte beds. Typically, individuals of this species are found buried to at least half their length in fine substrate, with the posterior end facing upstream (COSEWIC 2003). Since this species prefers stable habitats, it may be particularly threatened by dewatering and other activities that cause shifting substrates, water level fluctuations, and seasonal hypoxia or anoxia (COSEWIC 2003).

- Although it is possible that there are a few scattered individuals in tributaries of the Middle Fork John Day River, presence of the species in tributaries is unlikely. We are not aware of any documented presence in Middle Fork John Day River tributaries. No live or dead specimens of the species have been observed by district aquatics specialists during site visits to analysis area. Furthermore, many of the streams within the Camp Lick planning area are partially dry during the summer months. Camp Creek, the only mid-size stream in the planning area, has limited flow refuge and lacks deep enough fine sediment pockets that would serve as western ridged mussel habitat. It is unlikely that the western ridged mussel or its habitat is present within the planning area; therefore, this species will not be discussed further in this BE.

- **Pristine springsnail** (*Pristinicola hemphilli*) (R6 sensitive). Duncan (2008) states this species of snail is semelparous (reproduces a single time before dying), and males and females live 1 to 2 years. *P. hemphilli* is aquatic and breathes using gills. Snails feed upon algae, yeast, bacteria, and diatoms from rocks and woody surfaces, although they have been known to feed upon other plant surfaces. Plant matter transported by birds and mammals, as well as sediment passively moving downstream, may aid in this species dispersal. This species occurs at sites dominated by small, cold streams that are undisturbed (Duncan 2008). Populations at many of the sites contain hundreds of individuals, although numbers vary considerably from year to year due to environmental factors. *P. hemphilli* can also be found in interior Oregon in the Deschutes, Umatilla, and John Day River basins.

- Habitats supporting this species tend to be small, cold springs or seeps in a pristine condition and which contain coarse gravel or cobble substrate (Frest and Johannes 1999). Sometimes snails are found in larger springs or areas of small streams that are affected by springs. Plants commonly found in association with the species include watercress (*Rorippa*), monkey flower (*Mimulus*), and bryophytes (mosses). Sites tend to occur at low-medium elevation and are in semiarid sage scrub. Also, fairly dense Douglas-fir forests at low-medium elevation in the Cascades and Southern Oregon contain this species of snail.

- Small, cold springs in pristine condition within lower elevations are absent within the Camp Lick planning area. It is unlikely that the species or its habitat is present within the planning area; therefore, this species will not be discussed further in this BE.

- The western ridged mussel (*Gonidea angulata*) (R6 sensitive) may also occur in the Middle Fork John Day River which most of the streams in the planning area drain into.

Table 6. Miles of habitat for threatened, endangered, and regionally sensitive aquatic species in the Camp Lick planning area

Threatened and endangered aquatic species	Miles of habitat in the planning area
Mid-Columbia River steelhead critical habitat[1]	32.25
Redband trout[2]	47.98

Threatened and endangered aquatic species	Miles of habitat in the planning area
Columbia spotted frog[2]	47.98
Category 1 RHCA (acres)	47.98
Category 2 RHCAs (acres)	23.83

1. Threatened
2. Regionally sensitive species

Table 7. Miles of Mid-Columbia River steelhead critical habitat by stream within the Camp Lick planning area

Stream name	Miles of Mid-Columbia River steelhead critical habitat
Camp Creek	12.46
Cougar Creek	2.61
Cottonwood Creek	3.84
Coxie Creek	0.54
Eagle Creek	1.5
East Fork Camp Creek	0.71
Lick Creek	5.03
Trail Creek	0.41
West Fork Lick Creek	2.43
Whiskey Creek	2.72
Total	32.25

Aquatic species without special management status documented within or downstream of the aquatic analysis area include Mid-Columbia River Spring Chinook salmon (*Oncorhynchus tshawytscha*). Nongame fish within the aquatic analysis area include northern pikeminnow (*Ptychocheilus oregonensis*), mountain whitefish (*Prosopium williamsoni*), sucker species (*Catostomus macrocheilus or C. columbianus*), speckled dace (*Rhinichthys osculus*), longnose dace (*Rhinichthys cataractae*), redside shiner (*Richardsonius balteatus*), and sculpin (*Cottus spp*.).

Due to similarities in information considered for threatened, endangered, Region 6 sensitive, and management indicator species analyses, this information is consolidated within individual species narratives below.

Mid-Columbia River Steelhead – Affected Environment

Mid-Columbia River steelhead (Mid-Columbia distinct population segment [DPS], MCR steelhead) were listed by National Marine Fisheries Service (NMFS) as threatened under the federal Endangered Species Act (ESA) on March 25, 1999 (64 FR 15417). MCR steelhead is also a Malheur National Forest management indicator species (MIS). Critical habitat for MCR steelhead was re-designated on September 2, 2005 (70 FR 52630). Critical habitat is present in the aquatic analysis area.

MCR steelhead trout are the anadromous form of *O. mykiss*. Adult MCR steelhead return to freshwater from June through September. Adults overwinter in large rivers while sexually maturing. Adults resume migration to spawning streams in early spring. Spawning takes place from March through May. Eggs incubate during the spring and emergence occurs from April through July depending on water temperatures. Juveniles typically spend 2 to 3 years in freshwater. Juvenile MCR steelhead generally utilize habitats with higher water velocities than juvenile Chinook salmon. In winter, juveniles utilize deep pools with abundant cover. Juveniles may reside in their natal stream for their entire freshwater rearing phase or may migrate to other streams within a watershed. Smoltification occurs during late

winter and emigration to the ocean occurs during spring. MCR steelhead adults normally rear for 1 to 2 years in the ocean.

Population Status

Mid-Columbia River steelhead runs in the John Day River Basin are composed of entirely native stocks. However, hatchery fish do stray into the John Day Basin from the Columbia River [John Day Subbasin Revised Draft Plan (CBMRC&D 2005)].

The Middle Fork John Day River Subbasin contributes approximately 22 percent of the total run for the basin. Redd counts have displayed wide variability since 1964 (Figure 1) (ODFW 2007). Redds per mile in the Middle Fork John Day River Subbasin have been below ODFW management objectives (5.8 redds per mile) for nine of the past 16 years, but have met objectives for seven years (Figure 2) (ODFW 2016). Camp Creek surveyed sites for 2016 indicate that Camp Creek is not meeting ODFW management objectives and has 4.4 redds per mile (Figure 3), and Lick Creek is meeting ODFW management objectives and has 16.7 redds per mile (Figure 4) (ODFW 2016).

MCR steelhead occupy approximately 410 miles of habitat on the Malheur National Forest. The adult MCR steelhead escapement estimate for the Middle Fork John Day River IMW (Intensively Monitored Watershed), which is the portion of the Middle Fork Basin upstream of Ritter, was 1,676 for 2016 (Figure 5). For this portion of the Middle Fork John Day River Basin ODFW estimates that there is currently 281 miles of spawning habitat available to adult MCR steelhead. Based on the redd densities ODFW observed within their survey sites they estimate 1,261 observable MCR steelhead redds were present in the IMW portion of the Middle Fork John Day River this past spring (2016).

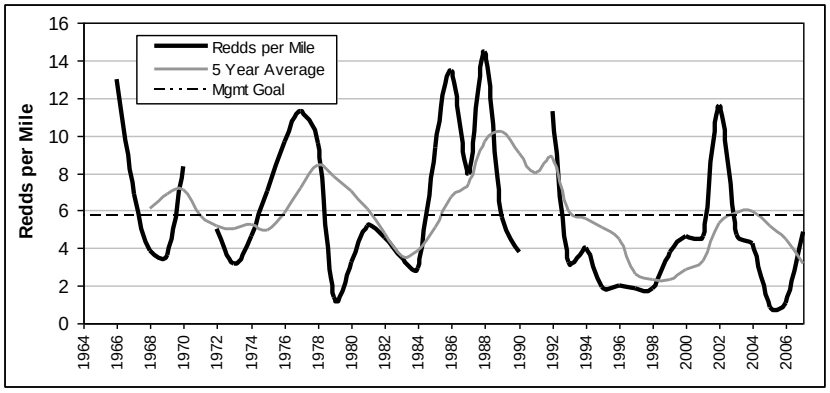

Figure 1. Number of redds per mile for Mid-Columbia River steelhead in the Middle Fork John Day River Subbasin, 1964 to 2007

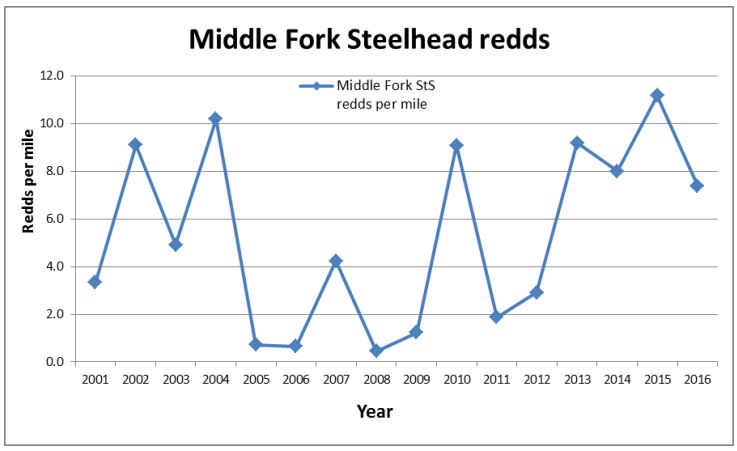

Figure 2. Number of redds per mile for Mid-Columbia River steelhead in the Middle Fork John Day River Subbasin, 2001 to 2016

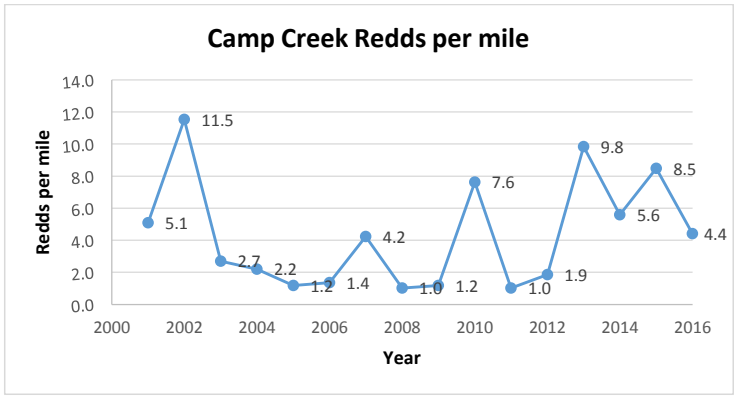

Figure 3. Number of redds per mile for Mid-Columbia River steelhead observed Camp Creek, 2000 to 2016

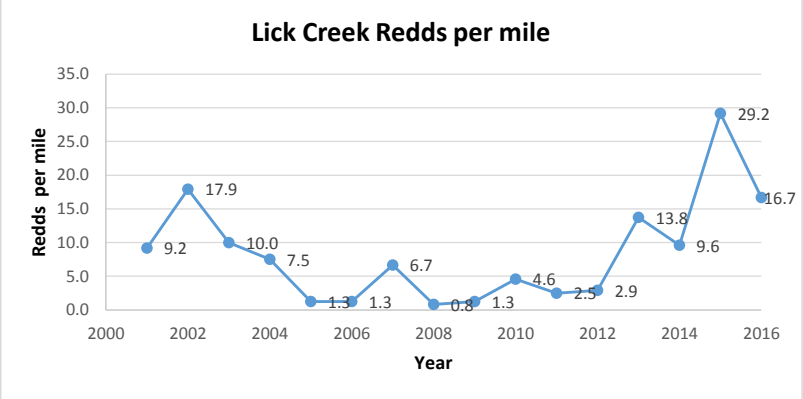

Figure 4. Number of redds per mile for Mid-Columbia River steelhead observed Lick Creek, 2000 to 2016

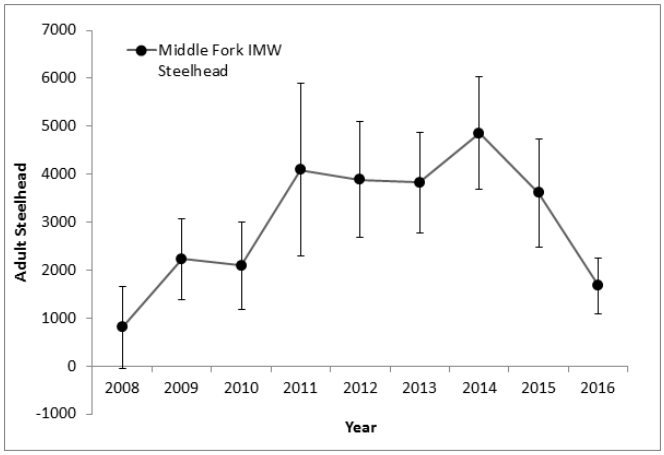

Figure 5. Adult Mid-Columbia River steelhead escapement estimate for the Middle Fork John Day River Intensively Monitored Watershed from 2008 to 2016

Distribution and Habitat

MCR steelhead are widely distributed in the Middle Fork John Day River Subbasin. Spawning and rearing takes place in all major tributaries of the Middle Fork John Day River. MCR steelhead utilize the Middle Fork John Day River for migration, as well as spawning and juvenile rearing habitat during years when water conditions are favorable. Spawning and juvenile rearing habitat are also present in Camp, Cougar, Cottonwood, Coxie, Eagle, East Fork Camp, Little Trail, Lick, Shoberg, West Fork Lick, Whiskey, and Trail creeks (Figure 6). MCR steelhead occupy approximately 32.25 miles of habitat within the planning area, which represents approximately 8.4 percent of available habitat on the Malheur National Forest. A combination of 1994, 2014, and 2016 surveys were used to update *O. mykiss* fish distribution (See redband trout Distribution and habitat section below), the updates are included in the maps for both MCR steelhead (Figure 6) and redband trout (Figure 7). Please note that no changes to the extent of Critical Habitat were made.

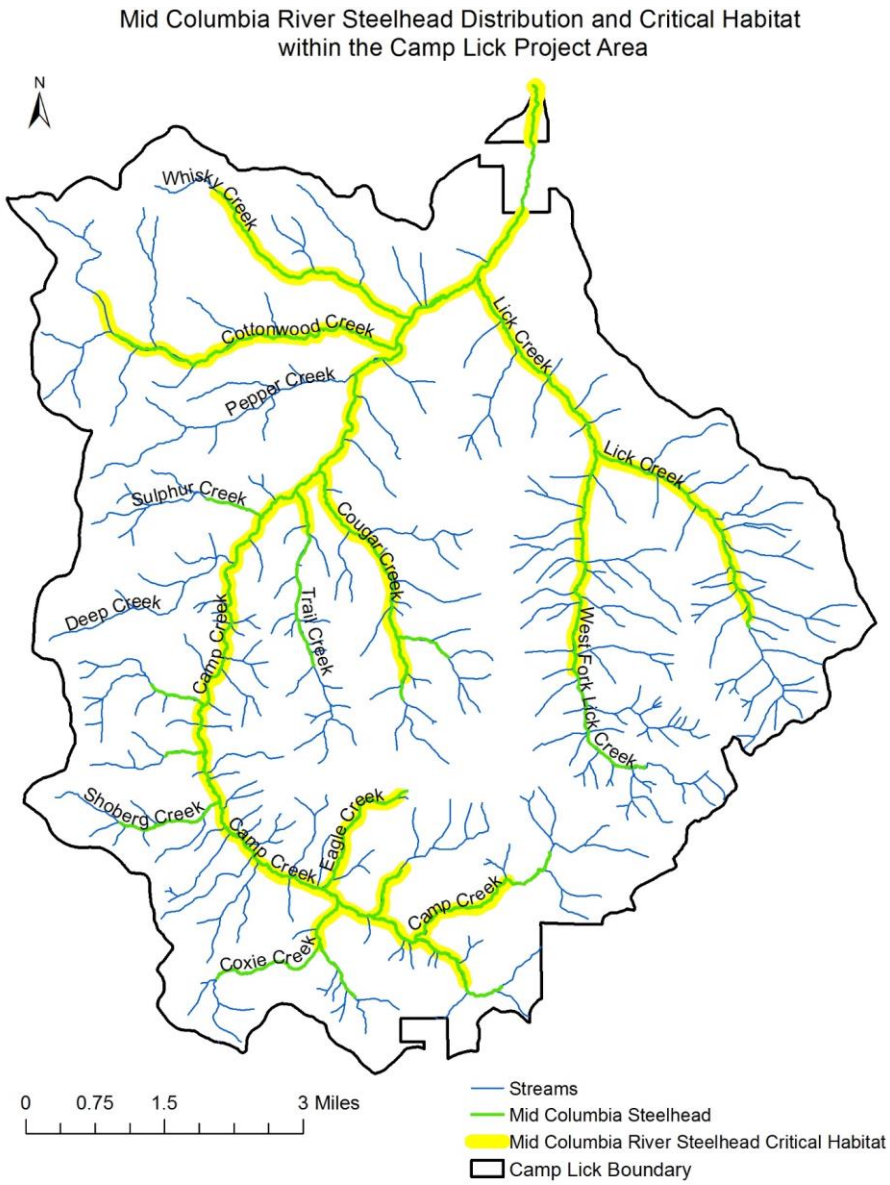

Figure 6. Mid-Columbia River steelhead distribution and critical habitat in the Camp Lick analysis area

Critical Habitat

Critical habitat was designated for MCR steelhead on February 16, 2000 (65 FR 7764). Critical habitat for MCR steelhead under the 2000 rule encompassed the major Columbia River tributaries known to support the distinct population segment (DPS), including the Deschutes, John Day, Klickitat, Umatilla, Walla Walla, and Yakima rivers, as well as the Columbia River and estuary. Critical habitat consisted of all waterways below long-standing (100 years or more), naturally impassable barriers, including the Middle Fork John Day River. The adjacent riparian zone was also considered critical habitat. This zone was defined as the area that provides the following functions: shade, sediment, nutrient and chemical regulation, stream bank stability, and input of LWD and organic matter. Protective regulations for MCR steelhead were issued under section 4(d) of the ESA on July 10, 2000 (65 FR 42423).

In late 2000, a lawsuit was filed challenging the NMFS February 2000 final designation of critical habitat for ESUs/DPSs of Pacific salmon and MCR steelhead listed under the ESA. A federal court ruled that the agency did not adequately consider the economic impacts of the critical habitat designations. In April 2002, NMFS withdrew its 2000 critical habitat designations.

Critical habitat for MCR steelhead was redesignated on September 2, 2005 (70 FR 52630). Streams listed in Table 4 were designated as critical habitat under the 2005 rule (Figure 6). Designated critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line (33 CFR 319.11).

In areas where the ordinary high-water line has not been defined, the lateral extent would be defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series.

The primary constituent elements (PCEs) that are essential for the conservation of listed DPSs on the Malheur National Forest are those sites and habitat components that support one or more life stages, including:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
(2) Freshwater rearing sites with:
  (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
  (ii) Water quality and forage supporting juvenile development; and
  (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
(3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Redband Trout – Affected Environment

Redband trout exhibit two major life histories, anadromous (MCR steelhead) and potamadromous. Potadromous redband trout exhibit a wide variety life history strategies in freshwater systems, including migratory (i.e., fluvial and adfluvial) and resident forms. Interior redband trout are a Region 6 sensitive species and a Malheur National Forest management indicator species. Redband trout are the resident form of *Oncorhynchus mykiss*. Redband trout may or may not be reproductively isolated from MCR steelhead. Redband and MCR steelhead trout from the same geographic area share a common gene pool.

Redband trout are sensitive to changes in water quality and habitat. This species prefer a water temperature range from 10 to 16 degrees Celsius (50 to 60.8 degrees Fahrenheit). A range-wide analysis by Muhlfeld et al. 2015 found that redband trout are generally found within streams where pool habitat comprises 35 to 60 percent of the total stream habitat. Poor habitat for redband trout is associated with water temperatures that exceed 16 degrees Celsius (60.8 degrees Fahrenheit), fine sediment greater than 25 percent, and a lack of stream shading. In montane streams, the distribution and abundance of redband trout has been positively related to abundance of deep pools with complex cover, and negatively related to stream gradient (Meyer et al. 2010; Muhlfeld et al. 2001a, 2001b; Muhlfeld 2002).

Adult redband trout are generally associated with pool habitats, although various life stages require a wide array of habitats for rearing, hiding, feeding, and resting. Pool habitat functions as important refugia during low water periods. An increase in sediment beyond the capacity of the stream to transport can lower spawning success; sediment reduces the quantity and quality of pool and interstitial habitat. Other important habitat features include healthy riparian vegetation, undercut banks, and large woody debris that function in sediment transport and deposition.

Redband trout may reside in their natal stream or may migrate to other streams within a watershed to rear. Habitat requirements are similar for redband trout and juvenile MCR steelhead.

Spawning occurs during the spring, generally from March to June. Redds tend to be located where velocity, depth, and bottom configuration induce water flow through the stream substrate, generally in gravels at the tailout area of pools. Water temperatures influence the emergence of fry, which is typically from May through June.

Population Status

Redband trout currently occupy 42 percent of their historical range within the western United States, of which 47 percent of the streams occupied by redband trout occur on private lands, 45 percent on government lands, and 8 percent in protected areas (Muhlfeld et al. 2015). Primary threats to redband trout include invasive species, habitat degradation and fragmentation, and climate change (Muhlfeld et al. 2015).

Neither ODFW nor the Forest Service routinely monitors abundance and distribution of redband trout in the John Day River Basin. Juvenile *O. mykiss* with resident (redband trout) and anadromous (MCR steelhead) life history types are difficult to differentiate where the two populations coexist, making independent monitoring difficult. Redband trout occupy approximately 1,100 miles of habitat on the Malheur National Forest.

Distribution and Habitat

Currently in the John Day Basin, redband trout are present in the North Fork, Middle Fork, Main stem, and South Fork John Day rivers and their tributaries. Redband trout are present in all fish-bearing streams in the Middle Fork John Day River Subbasin. Summer distribution of redband trout is generally limited to headwater areas.

Redband trout are present in all fish bearing streams in the aquatic analysis area (Figure 7), however their population abundance is unknown. Spawning and rearing habitat is present in all fish-bearing streams in the analysis area, with the Middle Fork John Day River also serving as a migratory corridor. Their distribution within the analysis area, and habitat needs, are similar to those of MCR steelhead. However, redband trout spawning may occur in areas with insufficient flow or two small of substrate for MCR steelhead spawning. Redband trout occupy approximately 48 miles of habitat within the planning area, which represents approximately 4.4 percent of available habitat on the Malheur National Forest.

Fish presence, and updates to layers that display fish bearing stream sections are updated using survey data. Updates to fish distribution in this document were made using a combination of 1994, 2014, and 2016 surveys. A 1994 stream survey observed redband trout in Sulphur Creek reach 1, fish presence ended 0.71 miles into the 1.8 mile stream survey. It stated that the major fish habitat problem appeared to be excessive fine sediment and a shortage of fish cover and large woody material. Aquatic biota surveys in 2014 found *O. mykiss* in: Whisky Creek reaches 1-4; Cougar Creek reaches 1 and 2 where fish distribution ended at a fish barrier culvert (dace were also observed in the first tributary); Trail Creek; and Big Rock Creek where fisheries distribution for the summer of 2014 ended before a barrier culvert. The 2014 surveys also found *O. mykiss* in Little Trail, Shoberg, and Eagle creeks. In Little Trail Creek, it was noted that a stringer meadow above the location of the last fish sighting is a possible fish barrier. It was also noted that the stream could use more large wood. In Shoberg Creek, 50 *O. mykiss* were observed or shocked between the third survey site and the last location where fish were observed. The end location of fish observed for this Shoberg Creek was also associated with the presence of a culvert with quality habitat above it; the culvert on NFS Road 3645081 is not a proposed haul route for the Camp Lick Project and removal of the culvert would be authorized under the 2014 Aquatic Restoration Decision. In Eagle Creek, fish distribution is again limited by a culvert that acts as a barrier, and where observations of heavy ungulate damage were made in 2016 (Aquatic Resources Report, Appendix B, Figure 60). The only 2014 aquatic biota surveys that resulted in no fish observations were those along Charlie Creek. It was noted that the stream is a small marshy meadow area and that it was difficult to shock the stream. The 2016 aquatic biota surveys found *O. mykiss* in a tributary to Cougar Creek, and a tributary to Coxie Creek. Given the size and location of the fish, the *O. mykiss* found in the Coxie Creek tributary are likely redband trout. Physical stream surveys done by ODFW have found MCR steelhead in: Camp Creek (1967), Lick Creek (1966), Cottonwood (1967), and Cougar Creek (1967).

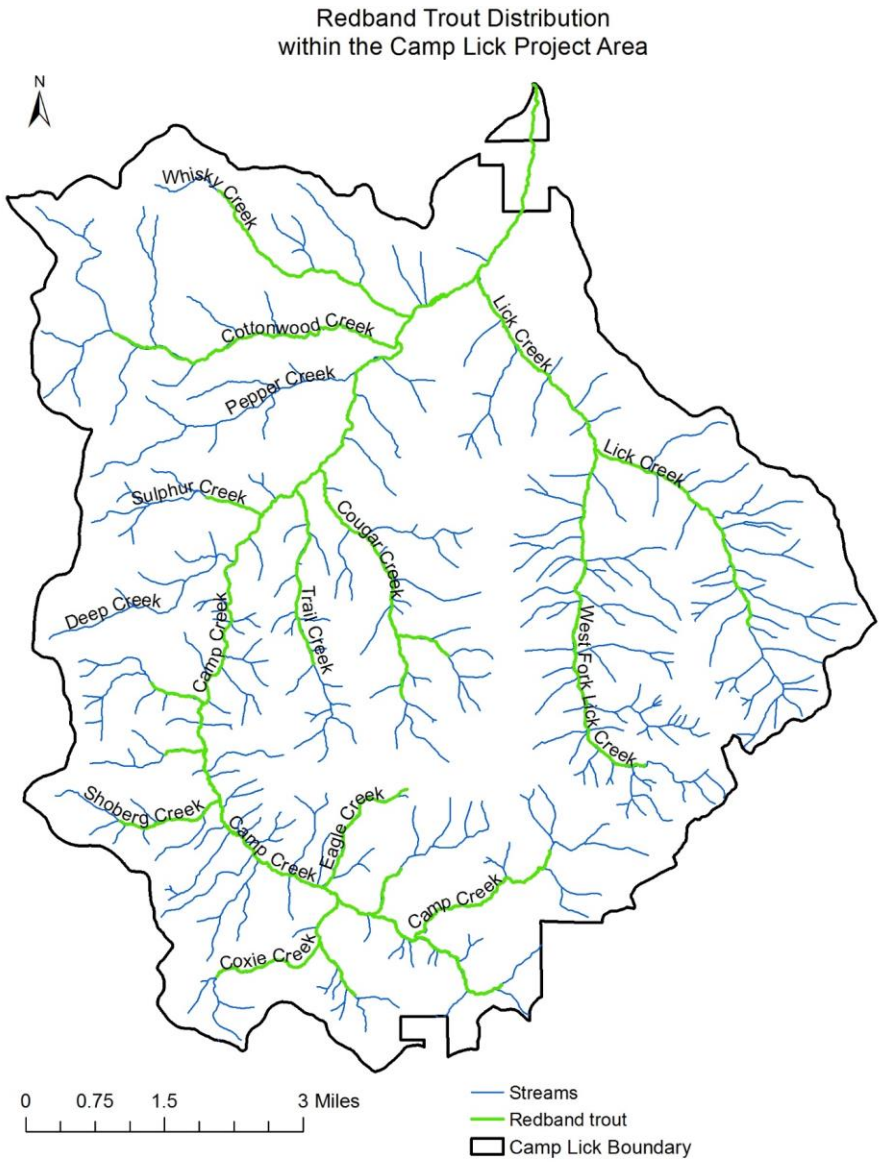

Figure 7. Distribution of redband trout in the Camp Lick analysis area

Columbia Spotted Frog – Affected Environment

The Columbia spotted frog is a Region 6 sensitive species. Spotted frogs are highly aquatic and are rarely found far from permanent water. They are most commonly associated with perennial streams, and less commonly with lakes, ponds, springs, and marshes.

During the winter, spotted frogs burrow into banks adjacent to streams, ponds, and springs. Breeding occurs in the spring varying with elevation. In the Columbia River Basin of Washington, breeding occurs from March to April in lower elevations, and from May to June in the higher elevations. Breeding habitat is usually found in quiet waters along streams or shallow water in ponds. Breeding may also occur in flooded areas adjacent to streams and ponds. Adults may disperse overland in the spring and summer after breeding.

Spotted frogs may be considered to occupy a similar range as redband trout on the Forest due to their predominantly stream-oriented habitat use. Spotted frogs would thus occupy approximately 48miles of habitat within the planning area, which represents approximately 4.4 percent of available habitat on the Malheur National Forest. The planning area is situated at the northern edge of available habitat on the Malheur National Forest.

Population Status

This species occurs in extreme southeastern Alaska, southwestern Yukon, northern British Columbia, and western Alberta south through Washington east of the Cascades, eastern Oregon, Idaho, and western Montana to Nevada (disjunct, Mary's, Reese, and Owyhee river systems), southwestern Idaho (disjunct), Utah (disjunct, Wasatch Mountains and west desert), and western and north-central (disjunct) Wyoming. Disjunct populations occur on isolated mountains and in arid-land springs. In Oregon, Columbia spotted frogs appear to be widely distributed east of the Cascade Mountains.

The FWS lists livestock grazing and the introduction of nonnative fish (salmonids and bass) as primary threats to the Great Basin population of Columbia spotted frogs (66 FR 1295).

Habitat in the Analysis Area

The spotted frog is considered present in all subbasins on the Malheur National Forest, including the aquatic analysis area. It is assumed this species is widely distributed in the Middle Fork John Day River Subbasin. Limited habitat surveys have been conducted specifically for spotted frogs; however, habitat probably exists along low gradient perennial streams. Fish surveys record incidental sightings of frogs but most do not differentiate species.

Environmental Consequences

Methodology

Information for the aquatic analysis was compiled from multiple sources. Region 6 (R6) stream survey reports provided existing condition data. Table 3lists the most recent stream surveys and data for the six primary aquatic habitat elements for 14 streams in the analysis area. Aquatic Resources Report, Appendix A displays stream survey data for the six primary habitat indicators and several other habitat metrics for Camp Creek.

The existing condition for potential fish bearing streams that have not been surveyed was evaluated qualitatively, based on principles of applied fisheries and watershed science, professional judgment, and knowledge of the area. Other sources of information considered for this report include field trips to

perennial portions of fish bearing streams within the planning area, the forest GIS layers providing spatial and tabular data, Forest water temperature monitoring data, streamnet.org, discussions with the Oregon Department of Fish and Wildlife (ODFW) personnel from the John Day Watershed District, and discussions with personnel from the Confederated Tribes of the Warm Springs Reservation of Oregon. Analysis for aquatic habitat was conducted by analyzing the impacts of the action for each alternative on the six aquatic habitat elements.

Spatial and Temporal Context for Effects Analysis

The planning area lies within the Camp Creek Watershed of the MFJD River Subbasin. The analysis area encompasses all known and potential habitats for threatened, endangered, region 6 sensitive, and MIS species that may be affected by the Camp Lick Project. Based on topography, drainage patterns, and the effects analysis, the Aquatic Analysis area (action area) includes the following streams and their tributaries: Camp, Whiskey, Cottonwood, Lick, West Fork Lick, Cougar, Little Trail, Trail, Shoberg, Coxie, East Fork Camp, Sulphur, and Eagle creeks. Measurable effects from proposed activities are unlikely to extend downstream of this area. The analysis area for aquatic species and the cumulative effects boundary are the same as used for aquatic habitat.

Effects timeframes for direct, indirect, and cumulative effects varies by habitat element. Measureable improvements in pool frequency, large woody debris (LWD), width-to-depth ratios, and bank stability are expected to occur immediately following habitat restoration activities, and persist in the long term (35 years or more).

A short-term increase in fine sediment and embeddedness may occur at and immediately downstream of aquatic habitat restoration treatment sites, but treatments would lead to a long-term reduction (5 years or more) in fine sediment levels and therefore would have beneficial impacts to aquatic habitat and fish. An increase of fine sediment is anticipated immediately after restoration activities within the first year followed by a steady decline to back ground levels or less over 5 years.

Stream shading may be reduced in the short term (5 to 10 years) at habitat restoration sites immediately following treatment, but are expected to return to baseline levels after that period. Measurable improvements in stream shading are expected to occur in the long-term (beyond 10 years) once the synergistic benefits of the proposed action and cumulative effects of improvements in passive riparian management are realized. Measureable increases in water temperature associated with the minor short-term reductions in stream shading are not anticipated. Restoration activities would have long-term beneficial impacts to aquatic habitat and fish.

Measurable improvements in water temperature are expected to occur in the long term beginning approximately 3 to 5 years after treatments, particularly in the Camp Creek watershed once hardwoods become reestablished. Such improvements are expected to extend downstream of the planning area to approximately the confluence of Camp Creek and the Middle Fork John Day River. Reduced peak flows and increased base flows associated with riparian and upland treatments are anticipated to contribute to reductions in water temperature in the long term as well. Increases in air temperature and reductions in snow pack (with associated increases in stream temperatures) described in some global climate change projections may offset expected improvements in stream temperatures resulting from the proposed action. However, the expected improvements in riparian vegetation and hydrological processes (water conveyance and storage) is expected to provide the resiliency required to prevent further water temperature warming than currently exists even with expected climate scenarios.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

All past activities, past wildfires, present activities, foreseeable activities, and the current project proposal have been considered for their cumulative effects on aquatic habitat and associated aquatic species. Effects are addressed for all aquatic species considered in this analysis together due to the insignificant differences between the species' niches. The following discussion focuses on the past, ongoing, and foreseeable future activities that may contribute positive or negative effects. The effects determination and rationale by species and alternative are discussed in the effects section and summarized in Table 18. The analysis area for aquatic species and the cumulative effects boundary are the same as used for aquatic habitat.

During the past 100 years livestock grazing, railroad construction, mining, timber harvesting activities, stream dewatering, firewood cutting, fire suppression, road construction, road density, lack of road maintenance, and general road use on public and private lands have contributed to landscape changes that may have affected processes such as overland flows, channel development, and riparian and fish habitat within the drainages associated with this project. Legacy effects from past management activities may continue to impact aquatic habitat in the planning area and downstream of the planning area. The magnitude and timing of these potential impacts are unpredictable, but they would have short-term (1 to 3 years) to long term (50+ years) negative effects on fisheries habitat in this watershed.

There has been a marked shift in the last 10 years to more intermediate harvest and greater crown retention. Since the PACFISH amendment (USDA Forest Service 1995a) to the Forest Plan, RHCAs have been left intact, limiting the effects to riparian habitat and stream channels. Recent projects incorporate watershed restoration projects that include increasing the size of culverts and removal of fish passage barriers, restoring streams to their historical channel alignment, installing fish screens to prevent entrainment, implementing BMPs, and decommissioning roads to decrease erosion and sediment delivery to streams.

The no action alternative would permit a natural slow, partial recovery from effects of past grazing, past riparian road construction, and past riparian harvest. This recovery would occur as riparian trees grow larger, as large wood falls into the streams, as channel types change to more stable and narrow configurations, as sediment from past actions is washed out, and as riparian shrubs and herbs recover and contribute to more stable stream banks. Recovery would be only partial because some ongoing impacts from some existing roads and railroad berms would inhibit full recovery.

Stream reaches within the planning area have improved due to riparian fencing, replacement of culverts, large wood placement, changes in livestock management, and riparian planting. Additionally, current grazing management practices within the planning area, have allowed stream reaches to improve and develop an upward trend. However, legacy timber harvest, adjacent roads, railroad berms, fire suppression, and stream crossings within the planning area have resulted in degraded stream conditions that the streams do not have the ability to recover from under current climatic conditions.

Aquatic habitat restoration activities proposed under the proposed action may result in short-term cumulative effects because the proposed activities would likely result in short-term increases in fine sediment, and water temperature. The short-term sediment increases may add to adverse effects because many streams in the analysis area already do not meet objectives for embeddedness and fine sediment and associated impacts to aquatic habitat and salmonids. However, the proposed aquatic habitat restoration activities would address current excessive fine sediment input and lack of the hydrological features that support fine sediment deposition (by adding instream large wood), leading to a long-term reduction in fine sediment levels. Aquatic habitat restoration activities would therefore have beneficial impacts to

aquatic habitat and fish. Under the proposed action, the hazard of a severe crown fire is lower than under the no action alternative, as described in the Camp Lick Fire, Fuels, and Air Quality Report.

The 2005 Final Rule for Travel Management, Designated Routes and Areas for Motor Vehicle Use (Travel Management Rule) requires national forests and ranger districts to designate those roads, trails, and areas that are open to motor vehicle use. The Malheur National Forest is not undertaking this process at this time. However, implementation in the future could restrict motorized travel to designated routes and restrict motorized cross-country travel. Implementation of this Rule on the Forest would reduce negative impacts to aquatic species and habitat associated with motorized travel within RHCAs.

Treatment of invasive plant infestations is authorized in the signed Malheur National Forest Site-Specific Invasive Plants Treatment EIS and decision (USDA Forest Service 2015a/b). Future treatment of these infestations would cumulatively result in fewer invasive plants and thus less impact to riparian areas and aquatic habitats.

The effects of other foreseeable activities described above on aquatic species are negligible with the exception of irrigation withdrawals that are potential temperature concerns. The effects of use and maintenance of roads that are not decommissioned would remain the same as at present.

The Camp Lick Project is a watershed restoration project which would be on a similar scale and include similar types of actions as the Magone and the Big Mosquito projects; the effects to aquatic habitat and species would likewise be similar.

Foreseeable Aquatic Restoration Actions (covered under the Aquatics EA NEPA) in conjunction with Camp Lick Project Actions Effects on the Six Primary Habitat Elements

Foreseeable aquatic restoration activities are summarized within Camp Lick PEA Appendix E – Past, Present, and Reasonably Foreseeable Future Activities. The effects of these aquatic restoration actions on the six primary habitat elements are summarized below and included in cumulative effects.

Pool Frequency

Reasonably foreseeable aquatic habitat restoration activities within the analysis area may result in short-term cumulative effects because the foreseeable activities would likely result in short-term increases in fine sediment that may reduce pool frequency within localized areas. The short-term sediment increases may add to adverse effects because many streams in the analysis area presently do not meet objectives for pool frequency and associated impacts to aquatic habitat and salmonids. However, the foreseeable aquatic habitat restoration activities would address current altered fine sediment transport processes and the lack of hydrological features that support pool formation, leading to a long-term reduction in fine sediment levels and an increase in pool frequency. Reasonably foreseeable aquatic habitat restoration activities would therefore have beneficial impacts to aquatic habitat and fish in the long-term. (See spatial and temporal context effects discussion above).

Stream Shading and Water Temperature

Reasonably foreseeable aquatic habitat restoration activities within the analysis area may result in short-term cumulative effects because the foreseeable activities would likely result in short-term decreases in stream shade. The short-term decrease may add to adverse effects because many streams in the analysis area presently do not meet objectives for water temperature and associated impacts to aquatic habitat and salmonids. However, the foreseeable aquatic habitat restoration activities would address the current riparian hardwood absence from localized stream reaches and reconnect floodplains through elevating water tables and invigorating riparian hardwood growth, leading to a long-term increase in stream shade levels and cool water storage resulting in improved water temperatures. Reasonably foreseeable aquatic

habitat restoration activities would therefore have beneficial impacts to aquatic habitat and fish. (See spatial and temporal context effects discussion above).

Large Woody Debris

Reasonably foreseeable aquatic habitat restoration activities within the inner portion of RHCA in the Camp Lick planning area may result in short-term cumulative effects because the activities would likely result in short-term and long-term increases in instream large woody debris (LWD). The short-term increases would benefit many streams in the analysis area that presently do not meet objectives for LWD and have associated impacts to aquatic habitat and salmonids. The reasonably foreseeable aquatic habitat restoration activities would address the current lack of instream LWD and the lack of hydrological features that support water storage, leading to a long-term increase in stocking levels of LWD for future recruitment. Foreseeable aquatic habitat restoration activities in the inner portion of the RHCA would therefore have beneficial impacts to aquatic habitat and fish. (See spatial and temporal context effects discussion above).

Reasonably foreseeable aquatic habitat restoration activities proposed for the outer portion of RHCA in the Camp Lick planning area may result in short-term cumulative effects because the activities would likely result in short-term and long-term decreases in stand density. Openings would in the short term decrease the amount of wood within the outer portion of the RHCA and would likely decrease high severity fire potential in areas that are thinned; however, in the long-term this decrease in stand density would enhance the growth of the trees that remain, resulting in larger trees. Reasonably foreseeable aquatic habitat restoration activities in the outer portion of the RHCA would therefore have beneficial impacts to aquatic habitat and fish. (See spatial and temporal context effects discussion above.)

Fine Sediment and Embeddedness

Reasonably foreseeable aquatic habitat restoration activities within the analysis area may result in short-term cumulative effects because the activities would likely result in short-term increases in fine sediment. The short-term sediment increases may add to adverse effects because many streams in the analysis area presently do not meet objectives for embeddedness and fine sediment and associated impacts to aquatic habitat and salmonids. However, the foreseeable aquatic habitat restoration activities would address current excessive fine sediment input and lack of hydrological features that support fine sediment deposition, leading to a long-term reduction in fine sediment levels. Reasonably foreseeable aquatic habitat restoration activities would therefore have beneficial impacts to aquatic habitat and fish. (See spatial and temporal context effects discussion above.)

Bank Stability and Width to Depth

Reasonably foreseeable aquatic habitat restoration activities within the analysis area may result in short-term cumulative effects because the activities would likely result in short-term increases in bank instability. The short-term increases would not result in an adverse effect to bank stability because the majority of streams meet bank stability criteria. Foreseeable aquatic restoration activities may add to adverse effects related to width to depth ratios because many streams in the analysis area presently do not meet objectives for width to depth ratios and associated impacts to aquatic habitat and salmonids. However, the foreseeable aquatic habitat restoration activities would address current width to depth ratios and lack of the hydrological features that support fine sediment deposition (streambank building characteristics) and reduce streambank sheer stress, leading to a long-term reduction in fine sediment levels and width to depth ratios, and an increase in floodplain connectivity. Reasonably foreseeable aquatic habitat restoration activities would therefore have beneficial impacts to aquatic habitat and fish. (See spatial and temporal context effects discussion above.)

Project design criteria (PDCs) for reasonably foreseeable aquatic restoration activities include those identified in the aquatic restoration biological opinion (ARBO II) (USDI FWS 2013) and those within the Malheur National Forest Aquatics Restoration Environmental Analysis (USDA Forest Service 2014). The ARBO II PDCs and Aquatic Restoration Decision PDCs specific to this project would be implemented as described in the ARBO II and the Aquatic Restoration Decision. In addition, any reasonable and prudent measures and terms and conditions (RPMs and T&Cs) from Endangered Species Act section 7 consultation with National Marine Fisheries Service and the U.S. Fish and Wildlife Service are non-discretionary and must be implemented as part of the Camp Lick Project to minimize the amount or extent of incidental take of MCR steelhead. The PDCs, RPMs, and T&Cs would reduce the probability and magnitude of this short-term risk. After about 2 years, effects of these activities are beneficial for water quality and fish habitat, including reduced sediment yield from the road prism.

Alternative 1 – No Action

Under alternative 1, no management activities would occur in the planning area as a result of the decision. Although there would be no direct or indirect effects from the no action alternative, some environmental outcomes would still occur as a result of the no action.

The hazard of a severe crown fire would be higher, as described in the Camp Lick Fire, Fuels, and Air Quality Report. Most of the forested stands in the planning area are identified as moderate to high risk for stocking induced mortality and related infestation of pests or disease. Without silviculture treatment and/or the controlled re-introduction of fire into the planning area, current stand conditions would worsen and increase the chance of a stand replacement fire. A stand replacement wildfire would result in the loss of shading along stream channels, loss of instream wood, and both short-term (3 to 5 years) and long-term (10 to 50 years) loss of streamside vegetation. This could adversely affect fish habitat. Water temperatures would increase, for perhaps one to a few decades, depending on riparian shrub and tree recovery. Sediment from upland sources could increase for 1 to 5 years following a fire. Sediment from channel sources could increase due to higher peak flows and loss of stabilizing trees and shrubs. However, recovery of bank stabilizing herbaceous and shrubby vegetation would probably limit increased sediment from channel sources to less than 5 years. Severe fire would also supply an extended pulse of woody debris to streams, which would gradually decay over decades. In addition, localized extirpation of these fish could occur as the result of severe wildfires (Rinne 1996).

As noted by Dunham et al. (2003), the effects of wildfires depend on a variety of factors including their timing, location, area, extent, and intensity. Other factors include the characteristics of the ecosystems and the species affected along with other indirect physical and ecological linkages. While such events can cause short-term negative effects, such as those listed below, over long time periods the resulting habitat conditions may be more productive then in areas where natural disturbance has been suppressed (Dunham et al. 2003). Wildfires can have a number of detrimental effects to stream channels such as decreasing stream channel stability, increasing discharge and affecting discharge variability, altering LWD delivery and storage, increasing nutrient availability, increasing sediment delivery and transport, increasing solar radiation and altering water temperature regimes (Dunham et al. 2003). In cases where natural stream processes are already impaired (Table 3), the recovery of the stream ecosystem from the effects of severe wildfire is likely to be slower, more sporadic, and potentially incomplete (Minshall 2003).

The Camp Lick Project area incorporates three priority watersheds which currently have a watershed restoration action plan (WRAP) with proposed essential projects. Many of the essential projects in the WRAP have been implemented. However, a number of the actions still remain, and would likely be completed using the Aquatic Restoration EA under the no action alternative which could expedite recovery of the watershed to some degree. However, excluding treatment of the uplands and RHCA

treatments would prevent more holistic watershed restoration. Projects outside the scope of the WRAP, included in the Camp Lick proposed actions under alternative 2 would not be implemented under alternative 1. Under alternative 1, the management activities in the planning area proposed in alternative 2 associated would not occur. However, the environmental outcomes resultant from reasonably foreseeable future actions are described below. Roads not included for treatment in the WRAP would not be treated in this alternative, which would allow several miles of roads to continue acting as potential sediment sources. Aquatic habitat restoration activities not included in the WRAP would not occur, allowing some streams to continue functioning in a degraded state and negatively affecting aquatic species habitat within the planning area and downstream reaches.

Some reasonably foreseeable fish habitat improvements including removal of railroad berms, large wood additions, beaver dam analog additions, riparian hardwood planting, and culvert replacement could occur under the Aquatic Restoration EA.

Direct and Indirect Effects – Pool Frequency

Alternative 1 would maintain the current levels of pool habitat, which are below objectives for streams in the analysis area (Table 3) and limit important habitat for salmonids, especially for rearing juveniles and adults migrating prior to spawning.

Direct and Indirect Effects – Water Temperature/Stream Shading

Alternative 1 would maintain the current levels of stream shading, with perhaps a slow increase as trees in previously logged riparian areas continue to grow at a retarded rate due to overstocked stands.

Current water temperatures exceed objectives for water temperature in nearly all streams in the analysis area (Table 3). Mean maximum water temperatures are above the suitable range for redband trout, and juvenile MCR steelhead, which are all present in the aquatic analysis area during the summer months. Water temperatures in most streams within the aquatic analysis area would likely not change over the short-term time due in part to the influence of valley bottom roads on streamside vegetation. Water temperatures in Camp Creek may slowly improve as streamside vegetation responds to improvements in range management activities. Recent range observations indicate that there is an upward trend in channel and stream bank vegetation in the analysis area. However, climate change models predict increases in air and water temperatures in the long-term (see Camp Lick Watershed Report).

The hazard from severe wildfire would be higher under this alternative than the proposed action, as shown in the Camp Lick Fire, Fuels, and Air Quality Report. If a severe wildfire does occur, stream temperatures would likely increase due to a large-scale decrease in stream shading.

Direct and Indirect Effects – Large Woody Debris

Alternative 1 would maintain the current levels of LWD. Current levels of LWD are below objectives for all but 2 stream reaches in the planning area (Table 3), resulting in degraded stream conditions including low pool frequencies. Replacement LWD would be recruited into properly functioning stream channels as conifers die and fall into streams, or as the stream undermines root systems and windfall or slide events cause trees to fall or slide into the stream. In incised/confined channels, wood would likely be suspended over the channel and not become incorporated as functional LWD. However, depending on tree species decay rates, over time these pieces break and are incorporated into the floodplain and stream channel. Limbs, treetops, and individual pieces of the tree bole become coarse woody debris, which are an integral part of debris jams associated with key pieces or LWD. Within 25 years, LWD would likely increase over current levels in the planning area because trees present in the floodplain of most stream reaches in the planning area would fall into streams. However, Forest roads parallel 12 of the streams (10 fish bearing

streams, and 2 non fish bearing steams that drain into fish bearing streams) within RHCAs, decreasing the area available for LWD growth and increasing the removal of trees for firewood. This decrease in large wood would also impact sediment transport influencing both the trapping of fine sediment (the preferred habitat for larval lamprey and when trapped behind large wood benefits salmonids by decreasing turbidity which can impact egg survival in redds), and aggradation of gravel which is utilized for spawning habitat; it also influences pool formation and habitat complexity.

The hazard from severe wildfire would be remain high under alternative 1, as shown in the Camp Lick Fire, Fuels, and Air Quality Report. If a severe wildfire does occur, a pulse of large wood likely would fall in most streams within the planning area over an extended period of time. The development of large wood along reaches with relatively few trees within the floodplain would be postponed for 90+ years until trees grow to suitable size and become recruited into the stream.

Direct and Indirect Effects – Embeddedness/Fine Sediment

Alternative 1 would maintain the current levels of fine sediment/embeddedness over much of the analysis area. Existing fine sediment levels are likely having adverse impacts to aquatic habitat. These adverse effects include reduced spawning success for salmonids and reduced quality of rearing habitat for juvenile salmonids. Fine sediment levels in the streams discussed above would slowly decrease as channels stabilize from past grazing and road building. However, native surface roads that are contributing fine sediment would stay in their current condition.

The hazard from severe wildfire would remain high under alternative 1, as shown in the Camp Lick Fire, Fuels, and Air Quality Report. If a severe wildfire does occur, a pulse of sediment would likely enter the streams due to soil erosion, and due to channel erosion from increased peak flows and decreased root structure on stream channels.

Existing native surface roads located in RHCAs not identified for removal in the WRAP would remain. Delivery of fine sediment to streams would continue at their current levels. Stronghold populations of salmonids are associated with higher elevation forested lands, and the proportion declines with increasing road densities (Quigley et al. 1996). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids. Specifically, Quigley et al. (1996) showed a strong correlation with road densities of 2 miles/square mile or higher and reduction of strong populations of salmonids. Further reductions of strong salmonid populations were identified at densities of 3 miles/square mile and 4 miles/square mile or greater. Roads in the planning area that occur within 100 feet of streams, or cross streams, commonly impact fish and fish habitat more than roads located in uplands.

A high percentage of roads in RHCAs in the planning area are native surface roads which contribute fine sediment to streams that adversely affect aquatic habitat. Total open and closed road densities are approximately 6.4 miles per square mile. There are approximately 327 miles of roads in the planning area that impact streams due to proximity (100 feet or less). These conditions reduce availability of subsurface cool water storage and have caused streams to become disconnected from floodplains.

Direct and Indirect Effects – Width to Depth Ratio

Alternative 1 likely would maintain the current width to depth ratios over much of the analysis area. Width to depth ratios are higher than objectives for all but 3 of the surveyed reaches in the analysis area (Table 3) and are likely having adverse effects to aquatic habitat, primarily through elevated water temperatures. Adjacent roads are influencing the channel morphology of several of these streams. Railroad berms on Camp Creek are also influencing channel morphology. Livestock grazing to Forest

Plan standards on allotments within the analysis area and natural LWD recruitment should maintain or slowly improve width to depth ratios of these streams.

Direct and Indirect Effects – Bank Stability

Alternative 1 would maintain the current levels of bank stability. Bank stability is generally high in the analysis area with the exception of specific locations where bank instability is occurring due to altered hydrological processes. Range allotment monitoring in allotments within the analysis area indicates that bank stability is on an upward trend. This trend is expected to continue under current grazing levels.

Cumulative Effects – Primary Habitat Elements

Under the no action alternative, streams not treated by foreseeable aquatic restoration activities (Camp Lick PEA, Appendix E – Past, Present, and Reasonably Foreseeable Future Activities) would continue functioning in a degraded state, negatively affecting aquatic species habitat within the planning area and downstream reaches. Recovery of localized areas due to changes in management would continue. However, degraded conditions related to altered sediment transport processes beyond the control of management would continue. The risk of severe wildfire would continue and wildlife habitat in upland areas would continue to decline in vegetative structure, resulting in a decrease of mountain mahogany and bitter brush within the planning area.

In the long-term, aquatic restoration activities would improve riparian condition and all six primary habitat elements within the planning area; however, the activities may have short-term negative and meaningfully measurable effects as described above. (See discussion of aquatic restoration effects past, present, and foreseeable activities relevant to cumulative effects analysis above.) Road and crossing improvements related to haul would not occur in this alternative, which would allow several miles of roads to continue acting as potential sediment sources, impede and intercept overland water flow, sediment transport and ground water seepage. Temporary road construction for haul would not occur and therefore effects related to fine sediment would not occur under the no action alternative. The threat of severe wildfire within the planning area and its potential impacts on aquatic organisms would increase into the future under the no action alternative.

Direct and Indirect Effects – Aquatic Species

Steelhead Determinations:

- Mid-Columbia steelhead ESA determination (T)[4]: no effect (NE).
- Mid-Columbia steelhead sensitive species determination (S)[5]: no impact (NI).
- Mid-Columbia steelhead management indicator species determination (MIS)[6]: no impact to viability.
- Mid-Columbia steelhead designated critical habitat ESA determination (D)[7]: no effect (NE).

Redband Trout Determinations:

- Interior redband trout sensitive species determination (S): no impact (NI).
- Redband trout management indicator species determination (MIS): no impact to viability.

Pacific Lamprey Determination:

- Pacific lamprey sensitive species determination (S): no impact (NI).

[4] T: Federally threatened
[5] S: Sensitive species from Regional Forester's list
[6] MIS: Management indicator species
[7] D: Designated critical habitat

Columbia Spotted Frog Determination:

- Columbia spotted frog sensitive species determination (S): no impact (NI).

Western Ridged Mussel Determination:

- Western ridged mussel sensitive species determination (S): no impact (NI).

Rationale:

Habitat for MCR steelhead, redband trout, Pacific lamprey, Columbia spotted frog, and western ridged mussel in the aquatic analysis area is currently in a degraded state; high water temperatures, high fine sediment levels, low LWD levels, and loss of floodplain connectivity from past land management practices have reduced the habitat capability of streams in the aquatic analysis area to support these species. Loss of cold water storage in meadows and stream networks has increased peak flows, reduced baseflows, and elevated water temperatures toward the upper end of thermal limits for salmonids. Legacy railroad berms along Camp Creek and associated loss of floodplain connectivity has resulted in high stream energy that prevents smaller streambed substrates from depositing, reducing the available spawning sites for MCR steelhead, redband trout, and possibly lamprey and available suitable habitats for mussels and lamprey to become established. Railroad grades in Camp Creek and inadequately functioning road/stream crossing structures limit aquatic species habitat connectivity.

The hazard from severe wildfire would remain high under this alternative. If a severe wildfire does occur, the lack of aquatic habitat connectivity may prevent fish from recolonizing disconnected streams after fire-related local extirpation (Rinne 1996).

Alternative 1 proposes no new activities. A slow and partial recovery of some habitat conditions would occur as a result of passive improvements in overall land management. If alternative 1 is selected, environmental outcomes would still occur. Aquatic Restoration activities included within the Camp Creek WRAP would likely still occur under the no action alternative, however the magnitude of these actions in facilitating recovery towards desired condition would be diminished and occur at a slower rate due to continual maintenance of the existing condition stated above

Cumulative Effects

Effects of Ongoing and Reasonably Foreseeable Actions

Although there are no cumulative effects from the no action alternative, as there are no direct or indirect effects. Potential environmental outcomes from alternative 1 would interact with outcomes from non-federal activities within the planning area and activities within the aquatic analysis area on federal, state, and private lands. Aside from this project, other non-restoration activities that may occur include; timber harvest activities, wildfires, livestock grazing, road use, flood irrigation/water diversion, and vegetation alteration.

The results of other foreseeable activities described above on aquatic species are negligible with the exception of irrigation withdrawals which are potential temperature concerns. The effects of use and maintenance of roads which are not decommissioned would remain the same as at present. The potential implementation of the 2005 Travel Management Rule would restrict motorized travel to designated routes and restrict motorized cross country travel. The pending implementation of this Rule on the Forest would reduce negative impacts to aquatic species and habitat associated with motorized travel within RHCAs.

Treatment of invasive plant infestations is authorized in the 2015 Final Record of Decision for the Malheur National Forest Site-Specific Invasive Plants Treatment Project. Treatment of these infestations wouldresult in fewer invasive plants and thus less impact to riparian areas and aquatic habitats.

Alternative 2 – Proposed Action

Design Features and Mitigation Measures

The following project design criteria and mitigation measures are included as Camp Lick PEA Appendix C – Project Design Criteria and are incorporated herein by reference. These measures have been found to be highly effective at minimizing any negative effects of projects similar to the Camp Lick Project on TES species and their habitats.

- General water drafting guidance for road maintenance and non-emergency fire use for watersheds with anadromous fish in the Blue Mountain Tri-Forest Area.
- National Marine Fisheries Service (NMFS) juvenile fish screen criteria for pump intakes.
- Relevant project implementation criteria for road maintenance activities as included in the 2010 ESA Section 7 informal consultation and Magnuson-Stevens Act essential fish habitat consultation for Malheur National Forest road maintenance activities 2010-2015.
- Best management practices selected for project implementation.
- Camp Lick project design criteria (PDCs) relevant to aquatics.
- Aquatic and riparian restoration programmatic consultation (ARBO II) PDCs relevant to the Camp Lick Project.

Proposed Action Project Elements

For the purposes of this analysis, the component parts of the proposed action are organized into the following project elements shown below:

- Timber felling includes silviculture treatments (stand improvement commercial thinning, lodgepole treatments, stand improvement biomass thinning, western white pine restoration, juniper encroachment treatments, yarding) and danger tree felling
- Riparian and upland watershed restoration (includes aspen restoration, ecological riparian treatments, meadow restoration, and headwaters restoration treatments)
- Fuels treatments (includes prescribed burning, piling and burning, and biomass removal)
- Temporary roads and landings
- Road decommissioning
- Road maintenance and use (includes haul, water drafting, open roads and road closures)
- Interpretive sign installation
- Range improvements (includes range fence construction)

Descriptions regarding proximity of project elements to aquatic resources are stated in only the first of the six primary habitat elements below (pool frequency) for brevity.

Direct and Indirect Effects – Pool Frequency

Timber felling includes silviculture treatments (stand improvement commercial thinning, lodgepole treatments, stand improvement biomass thinning, western white pine restoration, and juniper encroachment treatments, yarding) and danger tree felling.

The majority of timber felling activities would occur outside of RHCAs under alternative 2, therefore no meaningfully measureable effects to pool frequency are expected. The remaining analysis focuses on actions that would occur within RHCAs.

Under PACFISH, trees may be felled in RHCAs when they pose a safety risk (PACFISH standard RA-2). Danger trees felled within or into RHCAs would be felled into the stream where feasible or otherwise left within the RHCA. Felling of trees for road construction also has the potential to reduce the supply of

LWD to stream channels and therefore pool habitat; however, these trees would be treated in the same manner as danger trees as described above, and all road construction within RHCAs would occur on existing road beds requiring minimal tree removal to bring to a useable state. Where trees are felled into the stream, they may create pools.

Riparian and upland watershed restoration

Aspen restoration activities involve felling or girdling of conifers from up to 150 feet outside of 30 aspen stands to encourage expansion of the stands through a reduction in competition for light and water. Aspen restoration activities in the 30 aspen stands would occur on approximately 80 acres. Twenty-seven of the 30 aspen stands are within a RHCA, and three of the aspen stands are more than 150 feet away from the RHCA (Figure 8).

The 3 aspen stands outside of the RHCA are

- Unit PA 650, the stand is 963 feet from the active channel of a category 4 stream, 863 feet away from the RHCA
- Unit PA 645, the stand is 1040 feet from the active channel of a category 4 stream, 940 feet away from the RHCA, and over 1,000 feet from Camp Creek, not in RHCA
- Unit PA 651, the stand is 283 feet from the active channel of a category 4 stream, 183 feet away from the RHCA

Aspen restoration treatments would not likely result in adverse impacts to existing and future pool habitat due to the small scale of treatments, and because of mitigation measures proposed in project PDCs (Camp Lick PEA Appendix C – Project Design Criteria). Conifers would be felled into streams where feasible, thus LWD pool-forming processes may be accelerated in the short-term. The reduction in stocking densities following treatments would increase new growth of aspen and the vigor of larger aspen in the overstory for future LWD, to create pool habitat. The perimeter of aspen stands may be fenced in areas heavily impacted by ungulates. Natural barriers, hinging, or jackstrawing of conifers may be utilized as protection measures in place of fence in areas where appropriate.

Ecological riparian treatments involve the felling of trees, the creation of openings, and a possibility for commercial harvest in the outer zone of the RCHA (in category 1 streams this is the outer 200 feet of the RHCA buffer, in category 2 and 4 streams it is the outer 50 feet of the RHCA buffer). Within this treatment, all trees felled within the first 100 feet (on either side) of category 1 (fish bearing) and 2 (perennial streams), and the first 50 feet of category 4 stream within the RHCA would be used for stream/floodplain restoration purposes. Studies show that the majority of instream large wood originates from within 15 and 30 meters (49 and 98 feet) of the stream (Murphy and Koski 1989; McDade et al. 1990; Burton et al 2016). Thus, future large wood would likely not be removed from streams given the inner buffers on either side of the stream. The determination to leave an inner buffer on either side of streams was made so that treatments do not to limit streams from progressing towards riparian management objectives (RMOs) and the desired condition. Treatment of the outer RHCA, upslope of the inner buffer, would only occur in areas with slopes less than 30 percent, only where existing roads can be used for equipment access, and primarily where commercial harvest units are outside of and adjacent to the RHCA. The outer RHCA treatments would reduce stand density, reduce fire hazard, and improve forest health. Thinning would be utilized to reduce conifer density, increase available soil moisture for hardwood survival and regeneration, and increase forage production in stands that are closely related to adjacent uplands. The outer riparian treatment may contain a commercial component in areas where RMOs and desired conditions are met. Commercial harvest would only be considered once RMOs and desired conditions are met, and must be approved by district aquatics personnel once standards are met. Ecological riparian treatments would be implemented in multiple phases. No consecutive reaches of a given stream would be treated in a given year.

Treatments are proposed to enhance resiliency, restore biophysical processes and ecological function, and meet riparian management objectives defined by Malheur Forest Plan standards. Currently, riparian systems within the planning area are departed from their desired conditions. Some processes are present (shade), while other key processes, many of which are driven by the presence of large woody debris, are lacking (i.e., nutrient delivery from riparian hardwood litterfall, hyporheic flow, pool formation, sediment retention, and flood storage) and as a result, the ability of riparian areas to provide suitable water temperatures and habitat are at risk to an uncharacteristic wildfire. Approximately 2,300 acres, of treatment are proposed. Approximately 1,600 acres are proposed for the inner riparian habitat conservation area (RHCA), and approximately 700 acres are proposed for the outer RHCA, and include the creation of openings in the conifer canopy to allow for regeneration of hardwood tree and shrub species, and felling of large wood into the stream. This would occur in approximately 24 miles of fish bearing stream RHCAs and an additional 9 miles of category 2 perennial non-fish bearing stream (Table 8, and Figure 9). Thinning would not include large and old trees as defined in the silviculture treatment.

A summary of the riparian enhancement prescription is provided immediately below.

Warm Dry Plant Association Group

This treatment would apply to any ecological riparian treatment unit (inner RHCA or outer RHCA) within a Warm Dry plant association group (see the Camp Lick PEA Appendix B – Maps, Map 4). This treatment is designed to emulate a frequent, low severity fire regime. As a result, the desired future condition of the Warm Dry RHCAs would have decreased tree densities, be comprised of an old forest single stratum structure, and would have a species composition shift to early seral.

To move stands to the desired future condition, this treatment would have two components, the floodplain RHCA and the upland RHCA:

- Upland portions of RHCAs would be thinned to an average of 40 to 80 square feet per acre, to enhance large tree structure.
- A range of 5 to 25 percent of the upland RHCA would be left untreated as wildlife leave patches.
- Leave trees for both upland and floodplain portions of the RHCA, in order of preference, would include western white pine, Engelmann spruce, western larch, ponderosa pine, Douglas-fir, lodgepole pine, grand fir.
- Upland portions of RHCAs are generally more ecologically similar to upland units than to the inner portions of the RHCA, therefore they would be treated in a similar manner. Treatments would blend the outer portions of the upland RHCAs into the upland stands with a target of 40 square feet per acre near the upland edge and 80 square feet per acre near the inner edge of the RHCA.
- Floodplain portions of RHCAs would have periodic openings of a quarter to 1 acre in size created to stimulate or enhance the recruitment of riparian hardwoods. The openings would consist of approximately 20 to 30 percent of the floodplain RHCA. These openings would be placed in areas that have a high probability of riparian hardwood recruitment or enhancement, such as where live riparian hardwoods are currently occurring and where evidence suggests that hardwoods occurred in the past. In areas with openings, visual monitoring of ungulate impacts would occur at treatment sites; fencing of individual or patches of hardwoods may be implemented if necessary to achieve restoration goals.

Cool Moist Plant Association Group

This treatment would apply to any ecological riparian treatment unit (inner RHCA or outer RHCA) within a Cool Moist plant association group selected for treatment (see Camp Lick PEA Appendix B – Maps,

Map 4). This treatment is designed to emulate a relatively frequent, mixed-severity fire regime. For this treatment, the floodplain and upland RHCA would have three components: openings, variable density thinning, and leave patches. Similar treatment would be applied to Cold Dry and Cool Dry areas.

- Leave patches would consist of approximately 45 to 65 percent of the RHCA. Leave trees would consist of approximately 30 to 40 percent late seral species that include Engelmann spruce, Pacific yew, grand fir, and Douglas-fir. The remaining leave trees would be early seral species that include ponderosa pine, western larch, western white pine, and lodgepole pine.
- Openings would consist of approximately 10 to 20 percent of the RHCA. Openings would leave 0 to 40 square feet per acre of basal area of early seral species and would be one quarter to 1 acre in size, with the potential to increase that size to 2 acres if riparian hardwood regeneration occurs as expected. In areas with openings, visual monitoring of ungulate impacts would occur at treatment sites; fencing of individual or patches of hardwoods may be implemented if necessary to achieve restoration goals
- The variable density component would consist of approximately 15 to 45 percent of the RHCA; thinning would occur throughout the diameter range to 80 to 180 square feet per acre basal area to leave a multi strata stand. Visual monitoring of ungulate impacts would occur at treatment sites; fencing of hardwoods may be implemented if necessary to achieve restoration goals.

Since no wood that would likely contribute to pool forming features would be removed by ecological riparian treatments it is expected that the treatment would not have meaningfully measureable negative effects to pool frequency. Trees that are thinned and placed in the stream may create pools and thus would have a positive effect on pool frequency.

Table 8. Overall summary of river miles proposed for riparian habitat conservation area work

Stream category	River miles
1 (fish bearing)	23.71
2 (perennial)	9.12
4 (intermittent)	14.02
Ephemeral	0.97
Total	47.82

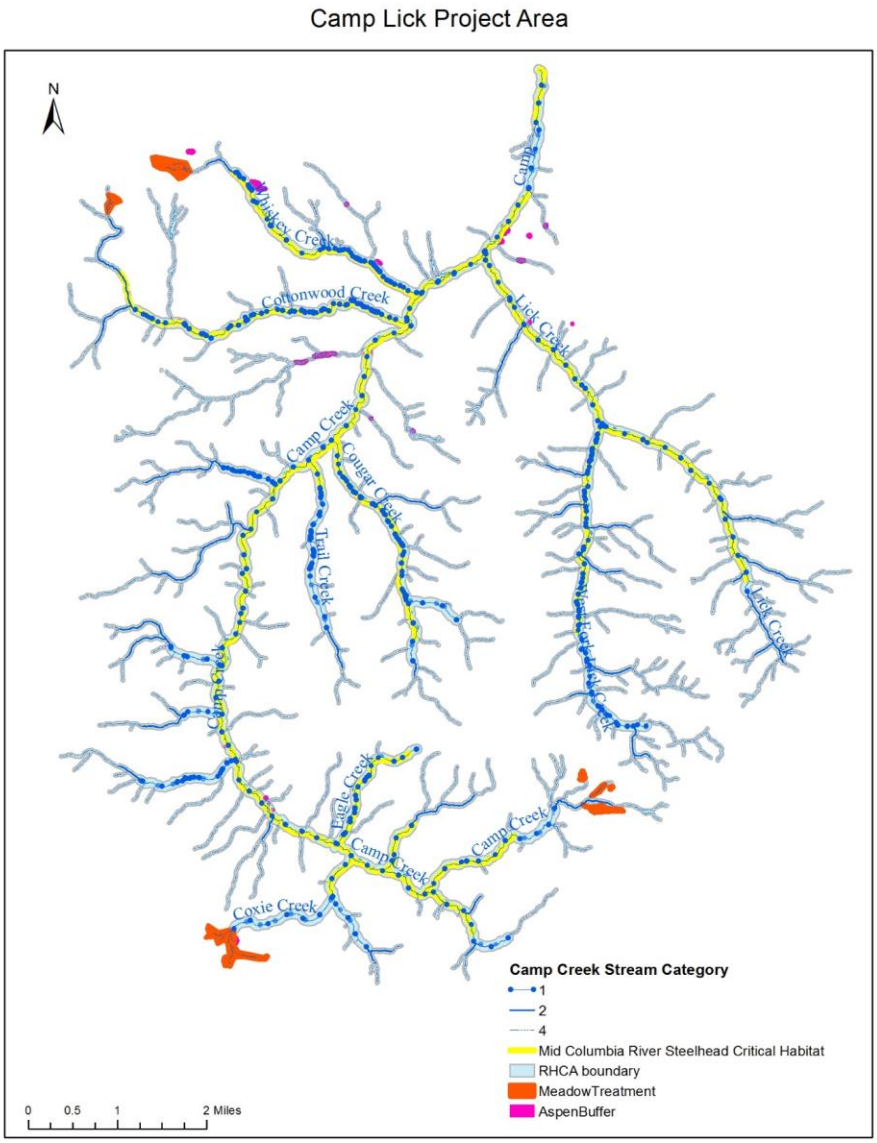

Figure 8 Alternative 2 Proposed Aspen and Meadow Treatments

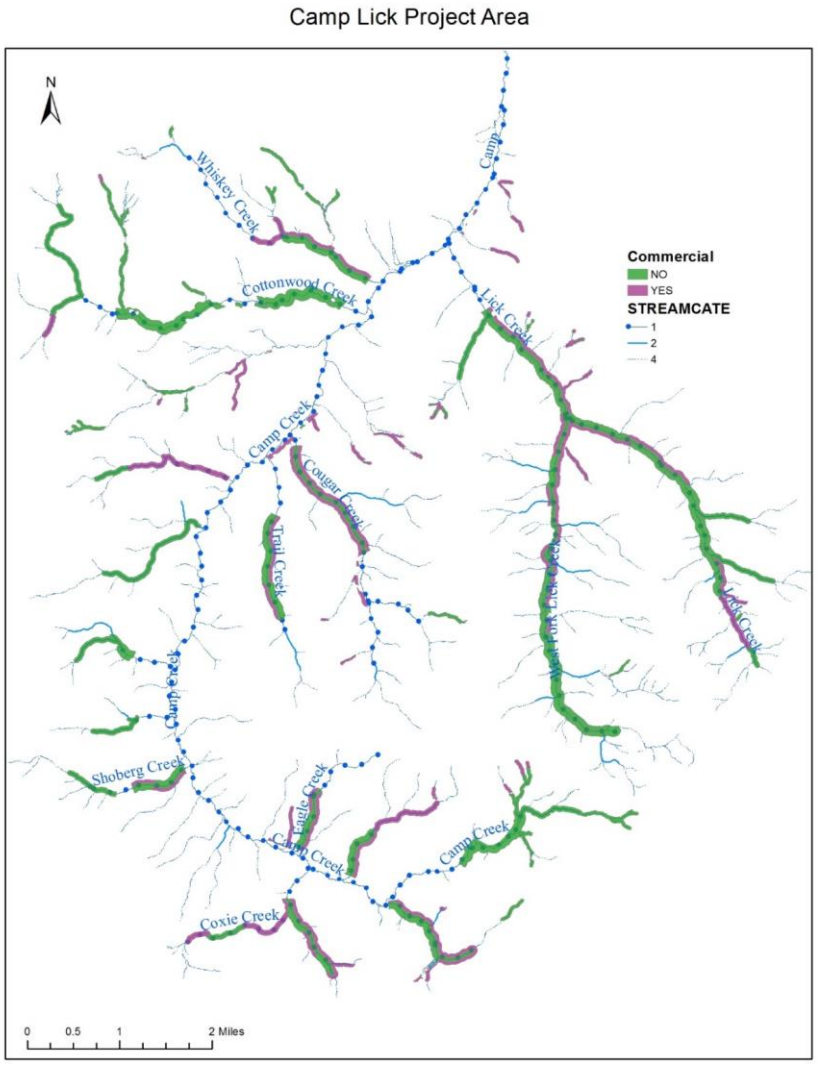

Figure 9. Location of ecological riparian treatments and locations identified for potential commercial treatment

Meadow restoration, in 10 meadow treatment units (Figure 8) of approximately 115 acres in size, are proposed, which involves felling small and medium size conifers, and would be done in areas where conifers are encroaching into the meadow boundary. The goals of this treatment are to restore large tree structure around the edges of meadows, increase intact hydric plant communities, and promote meadow functions of water storage and slow release into the late season. This treatment would remove conifers less than 21 inches DBH and younger than 150 years old, as defined by Van Pelt, encroaching within the meadow, and place them into or directly adjacent to the stream channel. Meadow treatment units located outside of the RHCA would have the potential for commercial byproduct removal. Meadow boundaries would follow topography on the ground and natural stand boundaries in order to decrease straight boundary lines and decrease edge effect. The meadow boundaries would be determined through soil mapping work done for the Terrestrial Ecological Unit Inventory, site visits, and professional judgment.

Meadow restoration treatments would not have meaningfully measureable effects to pool frequency because trees felled within the RHCA are being left in the area. Trees that are thinned and placed in the stream may create pools and thus could have a positive effect on pool frequency.

Headwaters restoration treatments are proposed in approximately 200 acres in the project area**.** None of the actions proposed in the headwaters restoration treatment are within the RHCA. This prescription is recommended to restore structural diversity to stands through emulating a fire disturbance across eight isolated upland areas; eight treatment locations are proposed with a total of approximately 200 acres treated. This treatment would reestablish structural stand diversity and hillslope processes on the landscape that would trend toward historic disturbance levels, while minimizing the risk of uncharacteristic wildfire. The landscape functions in these colluvial draws to collect sediment from hillslopes and store them, until an episodic pulses of sediment is released to the stream network. Fire return intervals in the blue mountains of Oregon in mixed conifer forests ranged from 7 to 24 years in drier sites and about 47 years for moister sites. The fires burned in a mixed severity regime with the higher severities in the moister sites (Agee 1996). Wildfires provide for increased overland flow runoff and soil saturation that historically generated a gulley in the ephemeral draw, thereby making a stream channel. These are natural processes that result from a characteristic wildfire regime. Emerging research in fire-dependent ecosystems (similar to the Camp Lick planning area in terms of precipitation, topography, forest types, and natural fire regimes) identifies debris flows as a 'disturbance' that is pivotal for maintaining productive and diverse aquatic ecosystems (Reeves et al. 1995; Flitcroft et al. 2015**).** The planning area has not experienced a wildfire larger than 15 acres since 1910 because of active fire suppression.

Limiting headwater restoration activities to areas outside of category 1, 2, and 4 RHCAs (Figure 10, and **Error! Reference source not found.**) and following Forest Plan ground cover standards, would control oil erosion and would prevent adverse impacts to existing and future pool habitat because of adequate vegetative buffers.

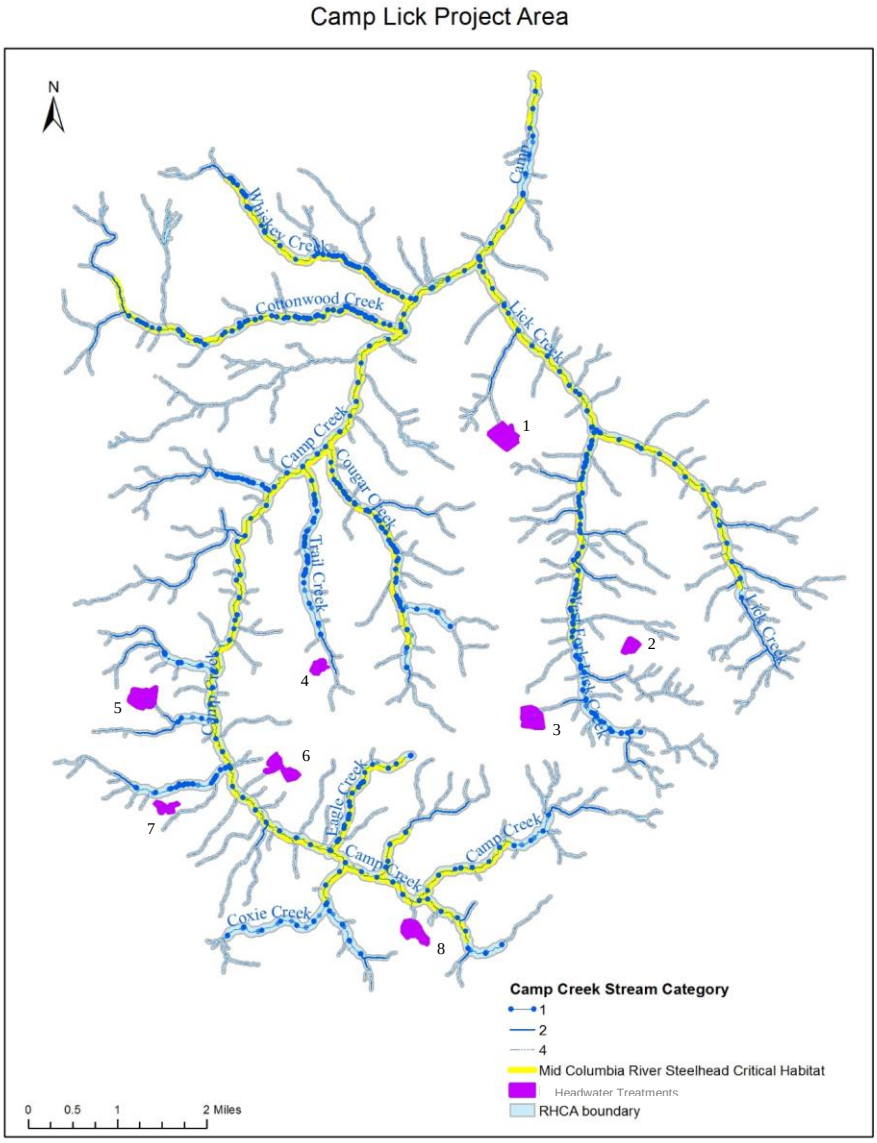

Figure 10. Locations of headwaters restoration treatments

Table 9. Headwater treatments distances to critical habitat

Treatment number as marked on Map	Acres	Miles from MCR steelhead CH	Comments (note none of the treatments are within the RHCA)
1	39.25	0.93	0.8 miles upslope of Lick Creek and MCR steelhead Critical Habitat (CH) , ~0.23 miles from an intermittent stream which is ~0.7 miles from Lick Creek and MCR steelhead CH.
2	14.00	0.50	Approximately 0.5 miles upslope of West Fork Lick Creek and MCR steelhead CH.
3	28.37	1.33	The treatment runs just outside of the RHCA of 800 feet of a category 4 stream. The stream that it next to is ~0.33 miles upstream of a category 2, perennial, section of the same stream, which is ~0.3 miles upstream of West Fork Lick Creek in a section of West Fork Lick Creek which is approximately 0.7miles from MCR steelhead CH. In total the treatment is 1.33 miles from MCR steelhead CH.
4	12.16	2.10	The treatment surrounds 538 feet of an ephemeral draw. 0.1 miles upslope of a category 2 perennial section of Trail Creek, which is 0.5 miles from the fish bearing (category 1) portion of Trail Creek which is 1.5 miles away from MCR steelhead CH. [8]
5	34.40	0.59	The treatment runs just outside of the RHCA of 510 feet of a category 4 stream, 0.15 miles from a category 2 section of the tributary that drains into Little Trail Creek. The treatment is 0.59 miles upstream of critical habitat.
6	26.64229	0.4 and 0.2	Two adjacent treatments are located on tributaries to Camp Creek between Steep and Charlie creeks. One treatment contains 0.03 miles of ephemeral stream and is 0.4 miles (of intermittent stream) upstream of Camp Creek and MCR steelhead critical habitat. The other contains 0.03 miles of ephemeral stream and is 0.2 miles upstream of MCR steelhead CH.
7	12.84977	0.4 and 0.9	Upslope of 2 Shoberg Creek ephemeral draws, 0.1 miles and 0.15 miles away from a fish bearing section of Shoberg creek. Shoberg Creek is a tributary to Camp Creek and MCR Steelhead CH.
8	28.10189	0.4	Upslope of a category 4 stream and is 0.4 miles of category 4 intermittent stream upstream of Camp Creek and MCR steelhead critical habitat.

Fuels Treatments (Prescribed Burning, Piling and Burning, and Biomass Removal)

The majority of the fuels treatment activities would occur outside of RHCAs and would have beneficial effects to fisheries resources by reducing surface fuels, thinning trees, stimulating growth of aspen and other hardwoods, and increasing the canopy base height.

Prescribed burning would occur within RHCAs to help restore plant species composition and structure that would occur under natural fire regimes. Ignition would occur within some RHCAs using drip torch and would stay at least 25 feet away from the stream to prevent drip torch fuel from entering the stream. Fire would also be allowed to back into RHCAs from adjacent upslope areas. Low-severity burns would predominately be used to restore the plant species composition and structure that would occur under natural fire regimes. However, moderate severity burns are permitted to invigorate decadent aspen stands, willows, and other native deciduous species, and may be targeted in no more than 20 percent of the area within RHCAs or Riparian Reserves/6th field HUC/year. Such burns would be contained within the observable historical boundaries of the aspen stand, willow site, other deciduous species, and associated meadows; additional areas outside of the "historical boundaries" may be added to create controllable burn boundaries. Burn prescriptions and project PDCs, and appropriate ARBO II PDCs would give the burn personnel a high degree of control over the burn intensities within the RHCAs to maintain the majority of the burn at a low intensity to minimize the severity on soils and riparian vegetation. These techniques would result in a patchy distribution of burned and unburned areas in RHCAs based on past prescribed

[8] PDCs that pertain to this treatment include Aquatic and Watershed-34-36

burning activities in RHCAs using the same technique. Firelines would not be constructed within RHCAs and would be waterbarred on slopes greater than 35 percent. Firelines would utilize existing constructed and natural barriers such as existing roads and streams, and would be rehabilitated to a natural state after use. Fireline construction would not occur down draw bottoms. Using these techniques, mortality of understory trees would occur in burned patches but few overstory trees would be killed.

Burning activities would not result in delivery of fine sediment to stream channels sufficient to result in a meaningfully measureable reduction of pool habitat. The reduction in stocking densities following burning activities would also increase the vigor of larger trees in the overstory for future LWD to create pools; this effect would be **positive and meaningfully measureable.**

No biomass removal activities associated with prescribed burning would occur in RHCAs.

Temporary Roads and Landings

Under alternative 2, landings and staging areas would not be located within riparian habitat conservation areas (RHCAs), unless approved by district aquatics personnel. Landings within the RHCA would be considered in order to accomplish the ecological riparian treatments if they are historical or existing landings, or are located upslope of a road, and must be approved by the district aquatics personnel. Limiting these activities to areas outside of RHCAs and to areas approved by aquatics would prevent adverse impacts to existing and future pool habitat.

Approximately 10 miles temporary road construction (Figure 11) would be necessary to access several timber harvest units. No temporary roads were added in order to facilitate ecological riparian treatments. Nine of the proposed temporary roads are within 100 feet of the RHCA (Table 10). No temporary road construction is proposed within in MCR steelhead critical habitat within alternative 2 (Table 11) and no temporary roads cross streams (Table 12). Only one of the temporary roads is in the RHCA; it is located partially within a category 1 RHCA and partially within the RHCA of a category 4 stream (Table 10). It is within a category 1 RHCA for approximately 200 feet, and is approximately 100 feet away from West Fork Lick Creek at its closest location, the temporary road is separated from West Fork Lick Creek and critical habitat by NFS Road 3675000. The temporary road comes off of NFS Road 3675000 and parallels a category 4 stream for approximately 515 feet, with the road ranging a distance of approximately 60-140 feet away from the stream.

Most temporary roads would have a discountable effect to fisheries resources due to one or more of the following: 1) they are located outside of RHCAs; 2) they are located on a category 4 RHCA more than 100 feet from the stream channel; or 3) with implementation of PDCs (including PDCs for currently decommissioned roads that would be hauled on), construction of temporary roads would not result in a meaningfully measureable reduction in pool frequency.

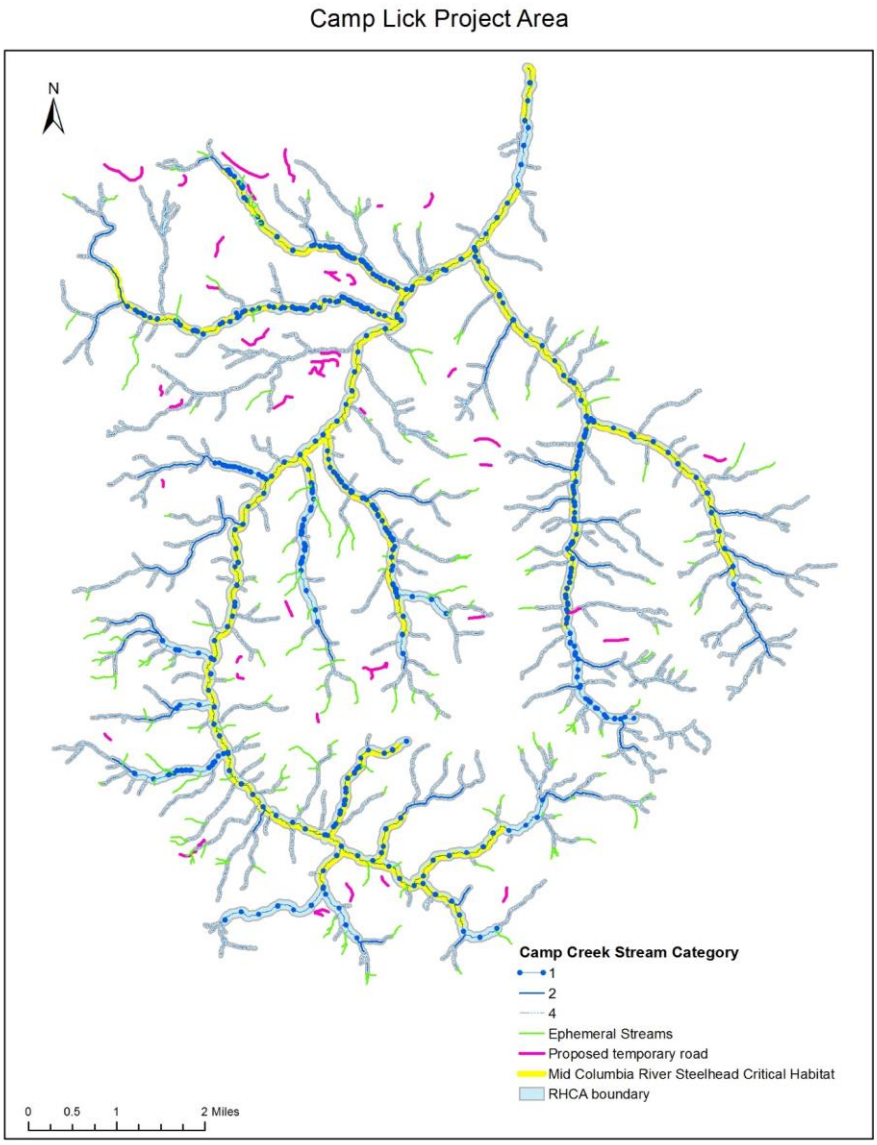

Figure 11. Alternative 2 proposed temporary roads

Table 10. Alternative 2 temporary roads within the RHCA buffer.

Temp Road Object ID	Total road miles	Closest distance of road to stream (feet)	RHCA Category
52	**0.13**	Approx. 100 feet from category 1 stream Approx. 57 feet from a category 4 stream	**1 and 4**

Table 11. Alternative 2 temporary roads/ closed to open roads within 100 feet of Mid-Columbia River (MCR) steelhead critical habitat

Road type	Miles within MCR steelhead critical habitat (100 feet)
Closed to open road	0
Temporary road	0

Table 12. Alternative 2 temporary roads/ closed to open roads within RHCA of Mid-Columbia River (MCR) steelhead critical habitat. Note the category 1 stream buffer is 300 feet on each side of stream.

Road type	Miles within MCR steelhead critical habitat RHCA
Closed to open road	0
Temporary road	0.04

Road Decommissioning

4.16 miles of road decommissioning would occur within the Camp Lick planning area, approximately 2.41 miles of those road miles are within RHCAs (Figure 12). There are 13 roads proposed for decommissioning, and nine of them are partially within the RHCAs (Table 12). All culverts, roadside ditches, and ruts would be removed on decommissioned roads per PDCs.

Decommissioning activities would result in the removal of a road from the permanent transportation system of the Forest. The impacts of the road on the environment would be eliminated or reduced to an acceptable level; the goal would be to leave the road in a "hydrologically disconnected" state and convert the former roadway to other resource uses. Decommissioning includes restoring hydrologic function by re-contouring, subsoiling, and scarification of the surface. Watershed design criteria identify specific measures for decommissioning.

The National Forest Management Act (NFMA) requires "re-establishing vegetative cover" on decommissioned roads within 10 years (16 USC 1608(b)). To accomplish this, the roadbed would be covered with natural materials such as logs, rocks, slash, and brush for a distance deemed to prohibit motor vehicle use; re-contouring, ripping and subsoiling, and seeding would occur as necessary; roads decommissioned within RHCAs would also be planted with conifers to maintain vegetation establishment and growth. Vegetation would be re-established as well via seeding and planting of hardwoods.

Road decommissioning activities would not include removal of trees that could function as LWD in stream channels, nor result in delivery of sediment to streams to a degree that pools are filled; therefore reductions in existing pool habitat would not occur. Trees would be planted on decommissioned road segments in RHCAs as part of the decommissioning process. Restoration of floodplain connectivity and stream channel complexity through road decommissioning, and revegetation activities would restore stream process and function, and result in a long-term increase in pool frequency over the long term that is positive and meaningfully measureable. Restoration of LWD recruitment processes on the sides of streams where roads previously occurred would increase and maintain LWD recruitment and resulting pool frequency in the long term (70 to 100 years).

Table 13. Camp Lick roads proposed for decommissioning and distances from riparian habitat conservation area (RHCA). Bolded roads are within the RHCA.

National Forest System Road	Surface Type	Existing road type	Distance from RHCA
3600617	Native surface	2-High clearance vehicles	>100 feet from a Category 4 RHCA
3600396	Native surface	2-High clearance vehicles	In the Camp Creek category 1 RHCA, the road runs along the creek for only 34 feet. It is away from the active channel, and at its closest distance from the stream is 0.23 miles away from the stream.
3650292	Native surface	2-High clearance vehicles	>100 feet from a category 4 RHCA and is not within 100 feet of the RHCA
360229	Native surface	2-High clearance vehicles	Approximately 309 feet of the road parallels the stream and approximately 476 feet of the road is within a category 4 RHCA
3650225	Native surface	1-Basic custodial care (closed)	The road is along the downslope side of an ephemeral stream which is a tributary to Charlie Creek, and is not within 100ft of the RHCA
3650716	Native surface	2-High clearance vehicles	The road is all within a category 2 RHCA
3600189	Native surface	2-High clearance vehicles	All within a category 1 RHCA along Eagle Creek and **crosses Eagle Creek and MCR steelhead CH**. The culvert needs to be removed when the road is decommissioned and the crossing needs to be storm proofed.
3600145	Native surface	2-High clearance vehicles	All within a category 1 RHCA in the Lick Creek RHCA, and crosses Lick Creek in two location.
3650397	Native surface	2-High clearance vehicles	Almost all within a category 4 RHCA and runs between two category 4 streams
3650712	Native surface	2-High clearance vehicles	All within a category 4 RHCA, runs parallel to a category 4 stream
3650699	Native surface	2-High clearance vehicles	All within a category 2 RHCA, runs along a category 2 stream
3660565	Improved Native surface	2-High clearance vehicles	All within a category 4 RHCA, runs parallel to a category 4 stream
3600619	Native surface	2-High clearance vehicles	This road is not within an RHCA, and is >500ft from a category 4 RHCA.

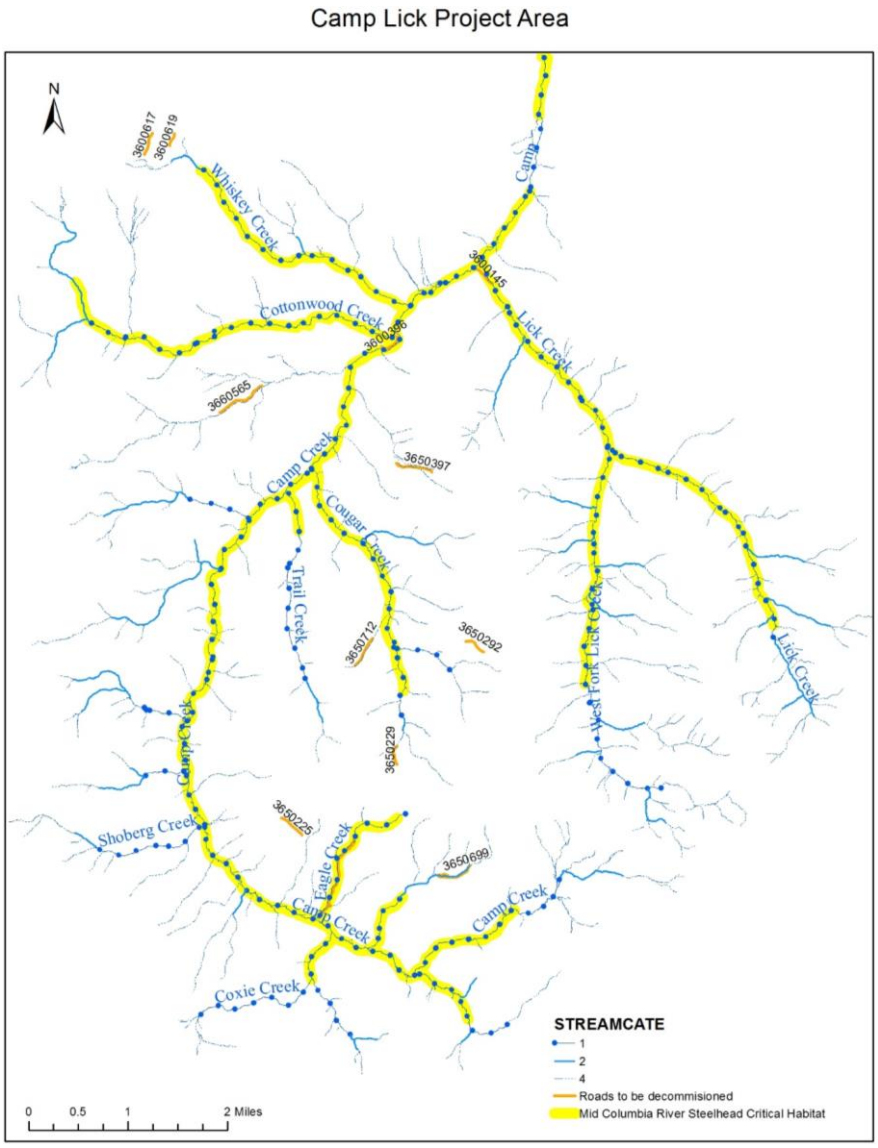

Figure 12. Roads proposed for decommissioning in relation to MCR steelhead critical habitat

Road Maintenance & Use (Haul, Water Drafting, Opening and Road Closures)

There are 294 miles of haul route proposed in alternative 2. Twenty-three of the 277 haul route roads segments cross MCR steelhead critical habitat (Table 13). Road maintenance for haul would occur on open or temporarily opened roads. With implementation of PDCs, delivery of fine sediment resulting from road maintenance and use would not be of sufficient magnitude to result in a meaningfully measureable reduction in pool frequency. Water withdrawals for dust abatement during haul activities would occur. Water withdrawals would be in accordance with the PDCs, including NMFS guidance. Use of these PDCs would ensure that water withdrawals do not result in a reduction in pool habitat.

Table 14. Alternative 2 Mid-Columbia River (MCR) steelhead critical habitat haul route stream crossings by road surface type

Road number	Stream crossed	Number of times crossed	Road surface type	MCR steelhead critical habitat
NFS Road 3600000	Camp Creek	3	Crushed aggregate / gravel	yes
NFS Road 3600000	Coxie Creek	1	Crushed aggregate / gravel	yes
NFS Road 3600000	Lick Creek	1	Crushed aggregate / gravel	yes
NFS Road 3600000	Whiskey Creek	1	Crushed aggregate / gravel	yes
NFS Road 3600000	Cotton Wood Creek	1	Crushed aggregate / gravel	yes
NFS Road 3640000	Category 1 Camp Creek tributary	1	Crushed aggregate / gravel	yes
NFS Road 3650478	Eagle Creek	1	Crushed aggregate / gravel	yes
NFS Road 3675000	Lick Creek	1	Crushed aggregate / gravel	yes
NFS Road 3640733	Camp Creek	1	Native Surface	yes
NFS Road 3650625	Cougar Creek	1	Native Surface	yes
NFS Road 3600517	Whiskey Creek	1	Native Surface (improved native material)	yes
NFS Road 3660000	Cotton Wood	1	Native Surface (improved native material)	yes
NFS Road 3645000	Cotton Wood	1	Native Surface (improved native material)	yes
NFS Road 3600421	Cotton Wood	1	Native Surface	yes
NFS Road 3660000	Cotton Wood	1	Native Surface	yes
NFS Road 3660630	Cotton Wood	1	Native Surface	yes
NFS Road 3650478	Cougar Creek	1	Native Surface (improved native material)	yes
NFS Road 3650000	Cougar Creek	2	Native Surface	yes
NFS Road 3600209	Cougar Creek	1	Native Surface	yes
NFS Road 3670650	Lick Creek	1	Native Surface	yes
NFS Road 3670633	Lick Creek	1	Native Surface	yes
NFS Road 3675514	West Fork	1	Native Surface	yes
NFS Road 3650226	Eagle Creek	1	Native Surface	yes

Opening 3.8 miles of one currently closed road, NFS Road 3600703 (a native surface road), is proposed in alternative 2. Zero miles of the road are within the RHCA of designated MCR steelhead critical habitat (Table 12). The road crosses seven streams and is within approximately 0.71 miles of RHCA. The road

crosses Sulphur Creek and is within the Sulphur Creek Category 2 RHCA for 0.1 miles, it crosses another category 2, perennial stream and is within its RHCA for 0.15 miles, is within Big Rock Creek category 1 RHCA for 0.11miles, is within the RHCA of 6 category 4 streams for 0.35miles and crosses 5 of those category 4 streams. With implementation of PDCs, delivery of fine sediment resulting from road maintenance and use would not be of sufficient magnitude to result in a meaningfully measureable reduction in pool frequency.

Of the 25.8 miles of open roads proposed for closure, 24 of the roads are within or partially within the RHCA (Table 15). Of those roads, 17 are proposed for haul. One of the roads proposed for closure is within 100 feet of MCR steelhead habitat, but does not cross the stream (Figure 13). Twenty-six of the roads proposed for closure are with 100 feet of the RHCA (Table 14). Approximately 0.6 miles of closed road are proposed within category 1 RHCAs, approximately 0.9 miles of closed road are proposed within category 2 RHCAs, and approximately 3 miles of closed road are proposed within category 4 RHCAs. There are 35 stream crossing total on roads proposed for closure, with water quality and road improvements proposed for each of these road segments (Table 14).

Closed roads are those roads on which motorized traffic has been excluded by regulation, barricade blockage, or by obscuring the entrance. Closed roads remains on the Forest Road Transportation System. Roads would be closed using gates or signs and would be left in a stable condition.

Road closure actions include construction of drainage structures that would be self-maintaining after closure. Closure of these roads poses a negligible risk of sedimentation to fish-bearing streams because dry land “filtration” lies between the closure sites and any streams, and the amount of land disturbed during gate construction is too small and too flat to produce significant sediment. However, since these roads would remain part of the forest road system, the benefits of the closures would likely not be permanent. Closure of these road segments would likely reduce delivery of fine sediment to the streams listed in Table 13. Because of the low risk of sedimentation from road closures and reduction in vehicle travel resulting in vegetation covering the roadbed, filling of pools and a reduction in pool frequency is expected to be positive but not meaningfully measurable.

Approximately 13 miles of road are proposed for confirmation of closure under alternative 2. These road segments, identified as ML 1, are included in this project so they can be documented as closed through the Camp Lick NEPA process. Many of these road segments are currently overgrown with natural vegetation, physically blocked with a gate or earthen berm, or the road prism is no longer visible. Closure of these road segments would not result in meaningfully measurable reduction in sediment delivery to subject streams, because the roads are already effectively closed on the ground. Closure of these roads would not result in a meaningfully measurable change in pool frequency.

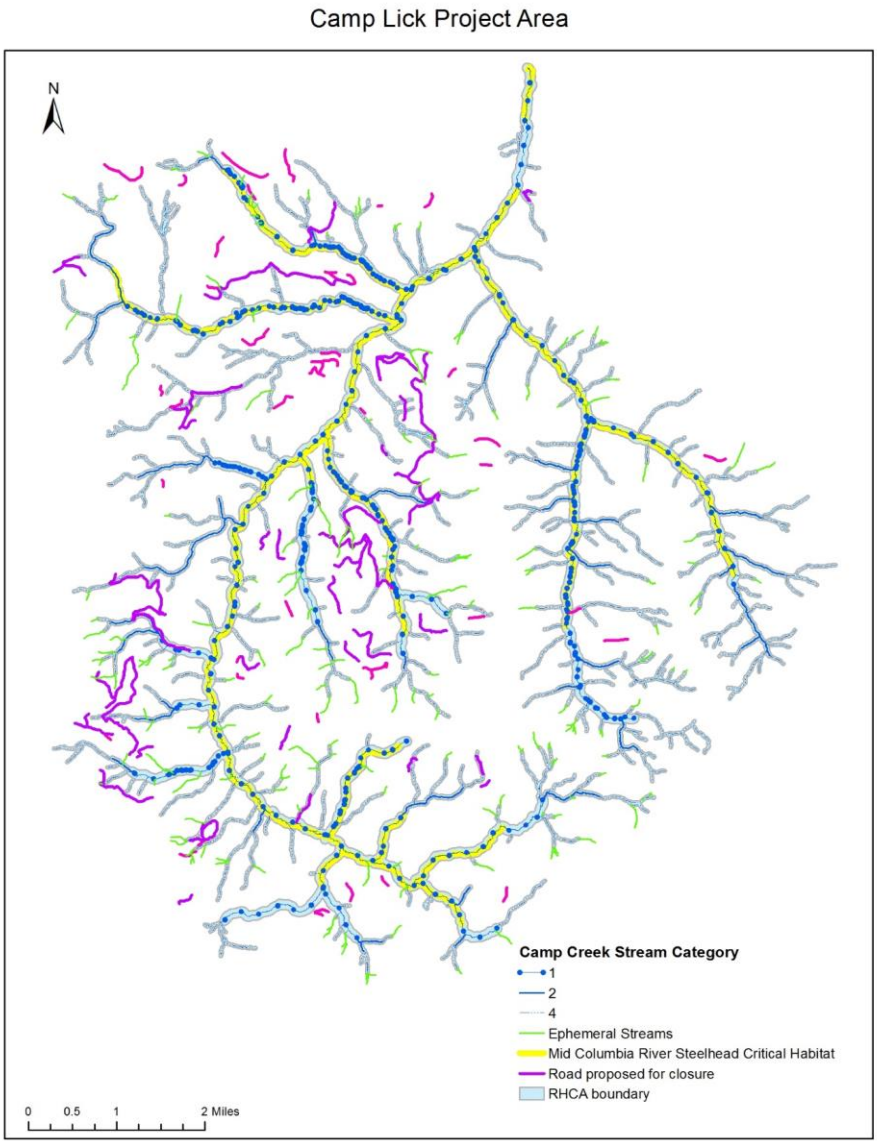

Figure 13. Alternative 2 roads proposed for closure

Table 15 Alternative 2 roads proposed for closure within the RHCA buffer, values in bold are also proposed for haul

Road Number	Surface Type	Existing road type (operating maintenance level)	Road miles	Miles of road within RHCA	RHCA category	Stream crossings	Water quality road improvements proposed
1800533	**Native material**	**2 - High clearance vehicles**	**1.68**	**0.05**	**4**	**One on Little Trail Creek**	**Stormproof and grass seed, add drainage dips and water bars.**
3620484	**Native material**	**2 - High clearance vehicles**	**0.69**	**0.18**	**4**	**Two on a tributary to Camp Creek**	**Stormproof, grass seed, and water bar.**
3600106	**Native material**	**2 - High clearance vehicles**	**0.1**	**0.05**	**4**	**0**	**Stormproof, grass seed and water bar.**
3620482	**Native material**	**2 - High clearance vehicles**	**0.17**	**0.02**	**4**	**0**	**Stormproof, grass seed, and water bar.**
3600905	**Native material**	**2 - High clearance vehicles**	**1.4**	**0.9 miles, 0.34 miles are within the Big Rock Creek category 1 RHCA. Paralleling the stream, at a distance ranging from 60 to 180 feet from the active category 1 channel. 0.6 miles of the road is within a category 2 RHCA, with approximately 0.55 miles of the road paralleling the category 2 section of stream.**	**1 and 2**	**Two on a tributary to Big Rock Creek in the category 2 non-fish bearing perennial section of stream**	**Stormproof, grass seed, water bar and remove perennial stream crossing culverts. Add large woody debris downstream of stream crossing.**
3600856	**Native material**	**2 - High clearance vehicles**	**0.73**	**0.08**	**2**	**One on a tributary to Whiskey Creek**	**Road maintained for haul. Stormproof, grass seed, clean culverts and water bar.**
3650360	**Native material**	**2 - High clearance vehicles**	**2.8**	**0.05 miles in a category 4, 0.2 miles in a category 2 RHCA**	**2 and 4**	**Two (one on an ephemeral tributary to a tributary of Camp Creek, one on a category 4 tributary to Camp Creek, one on an ephemeral tributary to Cougar Creek, and two on category 4 tributaries to Cougar Creek)**	**Road maintained for haul. Stormproof, grass seed and water bar. Clean culverts, repair drainage structures (24 inch culverts damaging road prism), add drainage.**
3650166	Native material	2 - High clearance vehicles	0.22	0.09	4	One on a category 4 stream	Stormproof, grass seed and water bar.

Road Number	Surface Type	Existing road type (operating maintenance level)	Road miles	Miles of road within RHCA	RHCA category	Stream crossings	Water quality road improvements proposed
3650358	**Native material**	**2 - High clearance vehicles**	**0.2**	**0.14**	**4**	**One on a category 4 stream**	**Stormproof**
3650700	Native material	2 - High clearance vehicles	0.07	0.04 miles are within a category 1 RHCA of Trail Creek. At its closest the road is 150 feet away from Trail Creek	1	One on an ephemeral tributary to Trail Creek	Stormproof, grass seed and water bar.
3650396	Native material	2 - High clearance vehicles	0.3	0.09	4	Two (once on 2 different category 4 streams)	Road maintained for haul. Stormproof, grass seed and water bar. Remove 2 18 inch culverts with grade sags after haul.
1800500	**Native material**	**2 - High clearance vehicles**	**0.9**	**0.06**	**4**	**One on an ephemeral stream**	**No issues identified**
3600686	Native material	2 - High clearance vehicles	0.77	0.05	4	0	Stormproof, grass seed, water bar.
3600686	Native material	2 - High clearance vehicles	0.5	0.2	4	One on a category 4 stream	Stormproof, grass seed, water bar.
3600534	**Native material**	**2 - High clearance vehicles**	**1.3**	**0.05 at its closest the road is 70 feet from a category 4 stream and crosses an ephemeral stream**	**4**	**One on an ephemeral stream,**	**Maintain for haul. Reconstruct water bars and drain dips, clean culvert and blade rilling areas.**
3600239	**Native material**	**2 - High clearance vehicles**	**0.4**	**0.4 miles/all of the road is within the RHCA and parallels the stream at approximately 50 feet the entire time**	**4**	**One on a category 4 stream**	**Reconstruct water bars and clean culverts. Stormproof, grass seed and more water bars.**
3600105	**Native material**	**2 - High clearance vehicles**	**0.11**	**0.03**	**4**	**One on a category 4 stream**	**Stormproof, grass seed and water bar.**

Road Number	Surface Type	Existing road type (operating maintenance level)	Road miles	Miles of road within RHCA	RHCA category	Stream crossings	Water quality road improvements proposed
3650026	Native material	2 - High clearance vehicles	0.23	0.23, all but approximately 25 feet	4	One on a category 4 stream	Stormproof, grass seed and add/reconstruct water bars.
3650395	**Native material**	**2 - High clearance vehicles**	**0.12**	**0.12**	**4**	**0**	Road maintained for haul. Stormproof, grass seed and water bar.
3650377	**Native material**	**2 - High clearance vehicles**	**0.8**	**0.13 in a category 4 RHCA paralleling the stream, only 25 feet away from the stream at its closest. O.07 miles in the category 1 RHCA of Cougar Creek, the road is 120 feet away from Cougar Creek**	**1 and 4**	**One on an ephemeral stream**	**Road maintained for haul. Stormproof, grass seed and water bar. Add drainage to springs in road prism.**
3660565	**Improved native material**	**2 - High clearance vehicles**	**1.06**	**0.76 miles (with a 250 feet of the road being between 0 and 10 feet of a category 4 stream, and 0.27 miles of the road paralleling the stream about at 50 to 90 feet away).**	**4**	**Two (one on two different category 4 streams)**	
3660240	**Native material**	**2 - High clearance vehicles**	**0.23**	**0.08 miles in a category 4 RHCA; road ends approximately15 feet from the stream**	**4**	**0**	
3660020	Native material	2 - High clearance vehicles	0.36	0.02 miles are within a category 4 stream. The road is approximately 70 feet away from the stream	4	1 ephemeral	
3650625	**Native material**	**2 - High clearance vehicles**	**1.7**	**0.1 miles in a category 4 stream, and 0.11 in a category 1 RHCA of Cougar Creek**	**1 and 4**	**Four (Three different ephemeral streams and one category 4 stream). One is within 100 feet of critical habitat, but does not cross the stream category 1 stream (Cougar Creek)**	

Interpretive Sign Installation

The installation of an interpretive sign would be aimed at adding interest and value to the public, describing the Forest's goal of restoring and maintaining a healthy, resilient landscape. The proposed sign would be installed along NFS Road 3600, where the railroad grade parallels Camp Creek and is visible from NFS Road 3600, between the junctions of NFS Raod 3650 at Cougar Creek and NFS Road 2045 at Lick Creek. This location would provide viewing access to the railroad grade with adequate room for single vehicle parking.

The proposed sign location is on an existing road pull out, thus sediment contribution from sign installation and viewing would not result in meaningfully measureable effects to pool frequency.

Range Improvements

Two fences would be constructed:

- One fence is approximately 1.72 miles long, with 0.33 miles in a category 1 RHCA of Camp Creek. The fence is being placed to separate Upper Camp Creek from the Dixie Allotment and would allow for better livestock management.
- One fence, approximately 1.9 miles long, encompassing approximately 73 acres, which runs along 0.85 miles of Cougar Creek and is almost entirely within the category 1 RHCA of Cougar Creek. Cattle would be excluded from the area within the fence through the creation of this riparian pasture. This fence would tie into an existing fence that crosses the creek. The addition to the fence would cross the creek once more.

Fences that are constructed and maintained on Forest land use the guidance of technical PNW-GTR-250 specifications for structural range improvements (Sanderson 1990), as well as the expertise of technical specialists to ensure that they have limited effects to the resources and wildlife that use it. Riparian fencing would indirectly affect riparian hardwood growth, by limiting browsing and helping move the location toward desired conditions. In the long term, the proposed fences would improve stream processes and functions by reducing or eliminating stream bank damage and heavy browsing issues. Although the beneficial effects of fencing streams to limit livestock access are clear, some negative effects are expected to occur at the fence crossing site.

Fence construction can result in minor streambank damage and add fine sediment to stream substrates. Sediment would likely be delivered to stream channels as a result of the proposed action; however the amount of sediment would not be of a magnitude to result in meaningfully measurable negative effects to pool frequency. The effects of reduced delivery of sediment to streams protected by fencing activities would be positive and meaningfully measureable for pool frequency over the long-term.

Direct and Indirect Effects – Water Temperature/Stream Shading

Timber felling includes silviculture treatments (stand improvement commercial thinning, lodgepole treatments, stand improvement biomass thinning, western white pine restoration, and juniper encroachment treatments), yarding, and danger tree felling.

The majority of the timber felling activities would occur outside of RHCAs under alternative 2, therefore no meaningfully measureable effects to water temperature and stream shading are expected. The remaining analysis focuses on actions that would occur within RHCAs.

Riparian and upland watershed restoration

Of the 30 aspen stands, 27 are within the RHCA, while three of the stands are greater than 150 feet from the RHCA (see description in pool frequency section above). Approximately 1.7 miles of aspen stands

along category 1 and 4 streams are being proposed for treatment (Table 16). Where possible, conifers would be dropped across the channel, which would provide cover and some additional shade, as would potentially raise the water table to further facilitate aspen restoration. As a result of the silviculture prescription to release shade for the expansion and accelerated growth of these aspen stands, it is expected that heights and densities of the units would be sufficient to return baseline shade conditions within 10 to 15 years.

Table 16. Linear distance of RHCA category being treated in aspen stands. Items in bold are meeting forest standards

Stream Name/Reach	RHCA Category	Linear Distance (Feet)	Shade (%)
Cougar Creek Reach 1	1	118	**71**
Camp Creek Reach 4	1	152	48.44
Cottonwood Creek Reach 1	1	296	**79.2**
Cottonwood Creek Reach 3	1	447	**95.5**
Camp Creek Reach 8	1	149	35.67
Category 4 Streams	4	7,656	No data available

After the first 10 to 15 years, shade is expected to improve beyond baseline. Other benefits include improved resiliency to fire within these aspen stands, an increase in deciduous leaf litter, bank root strength, overstory complexity, and the width and length of a true riparian community. As a result, it is expected that a 10 to 15 year reduction in shade may impact habitat through an increase in solar radiation, resulting in minor changes to the riparian microclimate. These changes are not likely to result in meaningfully measureable changes in stream temperature. See Camp Lick Watershed Report for additional analysis regarding the effects of the proposed action on stream temperatures.

Ecological Riparian Treatments

Ecological riparian treatments (approximately 2,300 acres) are recommended when the existing stand is overstocked to the point that tree vigor is declining, predisposing the stand to insect attack and uncharacteristic wildfire events due to buildup of fuels and crown density

Trees felled or tipped in the inner portion of the RHCAs would be felled or tipped into the stream where feasible and left within the RHCA. Conifers felled into streams would immediately shade a minor portion of the stream, reducing the short-term impact to shade from ecological riparian treatments. Felled conifers would also provide sheltered sites for riparian hardwood growth through reduction of browse by herbivores, which would enhance stream shading in the long term. Trees felled in the outer RHCA would be done in a manner that would not negatively impact stream shading and water temperature, per project PDCs.

The existing condition for stream shading currently exceeds Amendment 29 standards for most reaches identified for ecological riparian treatments (Table 16). As water tables rise in response to the suite of restoration actions, including ecological riparian treatments, invigorated hardwoods would restore stream shading conditions to baseline conditions in 10 to 15 years. Cold water storage and slow release, along with narrowing of over-widened channels, would increase the volume of water within stream channels and reduce solar gain. Accelerated growth of trees outside of the floodplain RHCA areas in response to treatments would contribute to restoration of baseline stream shading conditions. In the long term (15+ years) shade would exceed existing conditions and, along with the full suite of restoration actions identified, effects to water temperatures would be positive and meaningfully measureable.

Project PDCs minimize effects to stream shading and water temperature. However, the short-term reduction in stream shading may result in short-term effects to stream shading and water temperature that are negative and meaningfully measureable at the site scale, but not meaningfully measureable for temperature at the sixth field subwatershed scale. The beneficial effects of restoring fire-related riparian processes and functions include reduced chance of severe wildfire. The short-term negative effects of this action are minor when compared with the potential negative effects of severe wildfire.

Meadow restoration treatments are proposed on approximately 115 acres. This treatment would remove conifers less than 21 inches DBH and younger than 150 years old, as defined by Van Pelt, encroaching within the meadow and place them into or directly adjacent to the stream channel. Any commercial harvest of trees in this proposed action would occur outside of RHCAs. Project PDCs include those identified in the ARBO II for riparian vegetation treatment would minimize effects to stream shading and water temperature. However, the short-term reduction in stream shading may result in short-term effects to stream shading and water temperature there is a discountable probability that the localized effects would translate to measurable changes to water temperature and shade.

The silviculture prescription for the headwaters restoration treatment is not within the RHCA and because it is not near the streams' primary shade zone and outside of the RHCA the effects of the silviculture prescription component of the treatment to temperature and shade are not meaningfully measurable.

Fuels Treatments (Prescribed Burning, Piling and Burning, and Biomass Removal)

The majority of fuels treatment activities would occur outside of RHCAs and would have beneficial effects to aquatic resources by reducing surface fuels, thinning trees, stimulating growth of aspen and other hardwoods, and increasing the canopy base height.

Prescribed burning prescriptions and PDCs would give the burn personnel a high degree of control over the burn intensities within the RHCAs to maintain the majority of the burn at a low intensity to minimize the severity on soils and riparian vegetation. These techniques would result in a patchy distribution of burned and unburned areas in RHCAs based on the Forest's experience with past prescribed burning activities in RHCAs using the same technique. BMPs for low intensity burning include retention of at least 90 percent of stream shade. The prescribed burning would occur when moisture and climate conditions would minimize the potential for a high intensity burn. With a low intensity burn, very little stream vegetation providing shade is expected to be consumed under the more moist conditions encountered in riparian areas associated with perennial streams. In a recent study, Beche et al. (2005) found that a fall prescribed fire within the riparian zone of a mixed-conifer forest in El Dorado County, California was patchy in terms of intensity, consumption, and severity. Additionally, they found that although 49.4 percent of all tagged trees (greater than 11.5 centimeters or 4.5 inches) and snags were scorched by the prescribed fire, only 4.4 percent of all tagged trees were dead one year after the prescribed fire. In general, the trees killed by the prescribed fire were small and located near areas of high litter accumulation (Beche et al. 2005). Project PDCs, and forest plan standards would minimize the effects of fuel treatments in the RHCA. Ignition is allowed to occur outside of 25 feet of the stream bank and fire is allowed to back into the RHCA. Per the PDCs, low-severity burns would be used except where the objective is to restore deciduous trees, with a goal of creating a mosaic pattern of burned and unburned landscape. Moderate-severity burns are permitted only where needed to invigorate decadent aspen stands, willows, and other native deciduous species, and may be targeted in no more than 20 percent of the area within RHCAs or Riparian Reserves/6th field HUC/year. There amount of shade lost during low intensity burns is discountable and expected to be none or not enough to affect stream temperature.

Temporary Roads and Landings

Under alternative 2, landings and staging areas would not be located within riparian habitat conservation areas (RHCAs), unless approved by district aquatics personnel. Landings within the RHCA would be considered in order to accomplish the ecological riparian treatments if they are historical or existing landings or are located upslope of a road and must be approved by district aquatics personnel. Limiting these activities to areas outside of RHCAs and to areas approved by aquatics would prevent adverse impacts to existing water temperature and shade. Most temporary roads would have a discountable effect to fisheries resources (see discussion under Pool Frequency). Only one of the temporary roads is in the RHCA, it is within a category 1 RHCA for approximately 200 feet, and within a category 4 RHCA for approximately 515 feet (with the road ranging a distance of 57-140 feet away from the stream). This temporary road is outside of the primary shade zone for hill slope for slopes less than 30 percent (primary shade zone is 50 feet, slope distance), and hillslopes with slopes between 30-60 percent (primary shade zone is 55 feet, slope distance). Thus, the removal of shade associated with the construction of temporary roads would not have a negative effect to stream shading and water temperature that would not be meaningfully measureable**.**

Road Decommissioning

Road decommissioning actions would not have any immediate effect on shade. Removal of danger trees in RHCAs for decommissioning activities is not anticipated. Conifers and native riparian hardwoods would be planted in decommissioned road segments as part of the decommissioning process. Over the long-term (50 to 70 years), shading would increase beyond baseline as planted conifers become established and grow to a size that provides shading. A positive and meaningfully measurable effect on shade is expected for road decommissioning in the long-term.

Road Maintenance and Use (Haul, Water Drafting, Opening and Road Closures)

Road maintenance, haul, and road closures would have a neutral effect to stream shading and water temperatures. Water withdrawals for dust abatement during haul activities would occur. Water drafting can occur only as long as supply is adequate to provide for both fish and withdrawal. The maximum withdrawal from one site in an 8-hour period would be 18,000 gallons of water. Water withdrawals would be in accordance with the criteria described in the 2010 Malheur National Forest Road Maintenance BA and NMFS guidance, included in the Camp Lick PEA Appendix B - Maps. Use of these criteria would ensure that water withdrawals do not result in a measurable increase in water temperatures.

The opening of 3.8 miles of one currently closed road, which crosses 7 streams and is within approximately 0.7 miles of RHCA, would impact shade at the locations where the road crosses the streams; the road does not parallel any of the streams it crosses. Two category 2 streams and five category 4 streams would be crossed by the road. Opening the road could have negative impacts to shade at stream crossings. But because the affected area, the crossings, do not make a up large portion of the stream's shade zone, the impacts of opening the road would have a negative not meaningfull effect on stream shade and water temperature.

Road closure actions include construction of drainage structures that would be self-maintaining after closure. Closure of these roads poses a negligible risk for shade to fish-bearing streams since these closed roads may be open again, therefore trees would not likely grow of a sufficient size within the roadbed to provide shade. However, since these roads are being kept as part of the forest road system, the benefits of shade from these closures would likely not be "permanent." A positive but not meaningfully measurable effect to shade from road closures is expected.

Interpretive Sign Installation

The installation of an interpretive sign would be aimed at adding interest and value to the public, describing the Forest's goal of restoring and maintaining a healthy, resilient landscape. The proposed sign would be installed along NFS Road 3600, where the railroad grade parallels Camp Creek and is visible from NFS Road 3600, between the junctions of NFS Road 3650 at Cougar Creek and NFS Road 2045 at Lick Creek. This location would provide viewing access to the railroad grade with adequate room for single vehicle parking.

The proposed sign location is on an existing road pull out, there would be a minimal amount of ground disturbance to install the sign, with no felling of shade trees. This would result in no effect to shading or temperature.

Range Improvements (Range Fence Construction)

Some minor loss of stream shading vegetation may occur associated with range improvement activities; however, the negative effect would not be meaningfully measureable. The net benefits of these activities (reduced grazing and browsing of ungulates within RHCAs) are positive and expected to be meaningfully measureable.

Direct and Indirect Effects – Large Woody Debris (LWD)

Timber felling includes silviculture treatments (stand improvement commercial thinning, lodgepole treatments, stand improvement biomass thinning, western white pine restoration, juniper encroachment treatments), yarding, and danger tree felling.

The majority of timber felling activities would occur outside of RHCAs under alternative 2, therefore no meaningfully measureable effects to LWD are expected. The remaining analysis focuses on actions that would occur within RHCAs.

Riparian and upland watershed restoration

Aspen restoration treatments would not likely result in negative and meaningfully measurable effects to LWD due to the small scale of treatments. Trees felled within RHCAs would be felled into stream channels where feasible and become LWD, and thus LWD development may be accelerated in the short-term. The reduction in stocking densities following treatments would increase new growth of aspen and the vigor of larger aspen in the overstory for future LWD.

Approximately 2,300 acres, of ecological riparian treatments are proposed. Approximately 1,600 acres are proposed for the inner riparian habitat conservation area (RHCA) and approximately 700 acres are proposed for the outer RHCA, and include the creation of openings in the conifer canopy to allow for regeneration of hardwood tree and shrub species, and felling of large wood into the stream. This would occur in approximately 24 miles of fish bearing stream RHCAs and an additional 9 miles of category 2 perennial non-fish bearing stream (Table 8, and Figure 9). Thinning would not include large and old trees as defined in the silviculture treatment (please see direct impacts on pool frequency section above for more details on the proposed action).

Outer RHCA treatments would be no closer than 100 feet from category 1 or 2 stream channels, and no closer than 50 feet from category 4 stream channels, leaving a no-cut buffer within the primary wood recruitment zone that would prevent measurable impacts to LWD from this action. Sweeney and Newbold (2014) found that a buffer width equal to the height of mature streamside trees (about 30 meters) can provide natural LWD input levels. Trees within the inner zone of the ecological riparian treatments would be added to streams and floodplains to meet desired conditions using a combination of felling and tipping.

Openings within RHCAs associated with ecological riparian treatments activities would occur in 20 to 30 percent of the RHCA in Warm Dry plant association groups, and 10 to 20 percent of Cool Moist plant association groups. All stream reaches identified for ecological riparian treatments are also identified for LWD additions. Trees felled within or into RHCAs would be felled into the stream where feasible and left within the inner portion of the RHCA. Conifers felled into streams would immediately provide LWD. Accelerated growth of remaining conifers in response to thinning of overstocked stands would contribute to restoration of recruitment LWD. Short-term and long-term effects to LWD from the creation of openings (in the upland portions of the RHCA), thinning, and inner RHCA work would be positive and meaningfully measureable.

Potential commercial removal of large wood in the outer portion of the RHCA would be considered only after all RMOs and the desired condition are meet in a reach and requires aquatics approval. Due to the requirement of meeting all RMOs prior to any potential commercial harvest in the outer portion of the RHCA, the effects of the treatment are not expected to be meaningfully measurable.

Ten meadow treatment units, totaling approximately 115 acres, are proposed. The goals of this prescription are to restore large tree structure around the edges of meadows, increase intact hydric plant communities, and promote meadow functions of water storage and slow release into the late season. The treatment would remove conifers less than 21 inches DBH and younger than 150 years old, as defined by Van Pelt, encroaching within the meadow and place them into or directly adjacent to the stream channel.

Meadow treatment units located outside of the RHCA would have the potential for commercial byproduct removal. Meadow boundaries would follow topography on the ground and natural stand boundaries in order to decrease straight boundary lines and decrease edge effect. The meadow boundaries would be determined through soil mapping work done for the Terrestrial Ecological Unit Inventory, site visits, and professional judgment. Meadow thinning would have positive and meaningfully measureable effects on large wood.

Headwater restoration treatments, approximately 200 acres, do not propose the removal of large wood within the RHCA and coarse woody debris (downed woody debris) within units would be maintained for potential wildlife use and soil benefits. Thus, the effects of the treatment on LWD would not be meaningfully measurable.

Fuels Treatments (Prescribed Burning, Piling and Burning, and Biomass Removal)

The majority of fuels treatment activities would occur outside of RHCAs. Where prescribed burning does occur within RHCAs, the majority would be low intensity fires, using techniques that would achieve mortality of understory trees in burned patches but few overstory trees would be killed. Methods would be implemented as described in the Fuels Section to protect large trees. Fire intensities would not be high enough to consume trees or downed wood large enough to function as LWD in stream channels. The reduction in stocking densities following burning activities would increase the vigor of larger trees in the overstory. Consumption of coarse wood near stream channels greater than 4 inches DBH would be minimized. Beche et al. (2005) found that prescribed fire did not change the amount or movement of LWD in their study reach relative to unburned streams.

Temporary Roads and Landings

Under alternative 2, landings and staging areas would not be located within riparian habitat conservation areas (RHCAs), unless approved by district aquatics personnel. Landings within the RHCA would be considered in order to accomplish the ecological riparian treatments if they are historical or existing landings, or are located upslope of a road, and must be approved by the district aquatics personnel. Limiting these activities mainly to areas outside of RHCAs would prevent adverse impacts to existing and future LWD.

Approximately 10 miles temporary road construction (Figure 11) would be necessary to access several timber harvest units. No temporary roads were added in order to facilitate ecological riparian treatments. Nine of the proposed temporary roads are within 100 feet from the RHCA (Table 10). Most temporary roads would have a discountable effect to fisheries resources (see discussion under Pool Frequency). Sites requiring the removal of trees that could be recruited as LWD for temporary road construction are limited in size and frequency and would be left onsite. Conifers would be felled into streams where feasible as described above. In most cases, trees that can only safely be felled across the road often lean away from the stream channel and would be less likely to fall into stream channels where they could function as LWD. Further, only a percentage of conifers removed would be close enough to the channel to provide LWD. Temporary road construction would have a negative effect on LWD that would not be meaningfully measurable.

Road Decommissioning

Road decommissioning activities would not include removal of trees that could function as LWD in stream channels. Conifers would be planted in decommissioned road segments as part of the decommissioning process. Over the long-term (70 to 100 years) LWD recruitment processes would be restored on the sides of streams previously occupied by roads as planted trees become established, and trees that would have fallen across the previous roaded area are no longer cut and removed for vehicle access. Further, LWD additions would occur in streams associated with road decommissioning. Road decommissioning would have a positive effect on LWD that would be meaningfully measureable.

Road Maintenance and Use (Haul, Water Drafting, Opening and Road Closures)

Activities would not likely result in a reduction of LWD to category 1, 2, or 4 RHCA stream channels because in most cases, trees that can only safely be felled across the road often have a lean away from the stream channel and would be less likely to fall into stream channels where they could function as LWD. Where conifers are felled into the stream, they would immediately function as LWD. The effects of this action would be negative for LWD but would not be meaningfully measurable.

Road closure actions include construction of drainage structures that would be self-maintaining after closure. Closure of these roads poses a negligible risk for LWD to fish-bearing streams since these closed roads may be open again therefore trees would not likely grow of a sufficient size within the roadbed to provide LWD. Firewood cutting within the RHCA may be reduced as a result of road closure. However, since these roads are being kept as part of the forest road system, the benefits to LWD from these closures would likely not be permanent. As a result, road closure is expected to have a positive but not meaningfully measurable effect on LWD.

Interpretive Sign Installation

The installation of an interpretive sign would be aimed at adding interest and value to the public, describing the Forest's goal of restoring and maintaining a healthy, resilient landscape. The proposed sign would be installed along NSF Road 3600, which parallels Camp Creek. Because interpretive signage along Camp Creek would not require the removal or felling of trees, no effect to LWD is expected.

Range Improvements (Range Fence Construction)

Two range fences, including three stream crossing, are proposed in alternative 2. Some trees may be felled associated with range improvement activities that could function as LWD in stream channels; however, trees would be felled into the stream where feasible. The negative effect would not be meaningfully measureable. The net benefits of these activities on riparian processes and functions are positive and expected to be meaningfully measureable.

Direct and Indirect Effects – Embeddedness/Fine Sediment

Timber felling includes silviculture treatments (stand improvement commercial thinning, lodgepole treatments, stand improvement biomass thinning, western white pine restoration, and juniper encroachment treatments, yarding, and danger tree felling.)

The majority of timber felling activities would occur outside of RHCAs under alternative 2, therefore no meaningfully measureable effects to embeddedness and fine sediment are expected. No meaningfully measureable effects to embeddedness and fine sediment are expected with the implementation of PDCs (see Camp Lick PEA, Appendix C – Project Design Criteria).

Riparian and upland watershed restoration

Approximately 80 acres of treatment are proposed to improve 30 aspen stands and allow for expansion where appropriate. To reduce shading and competition, conifers would be removed or girdled up to 150 feet (cut distance) from the existing aspen stand's perimeter. Ponderosa pine with high ground-to-crown height may also be retained because the shade produced by these conifers does not typically fall within the aspen stand. Heavy equipment may be used during aspen restoration treatments. PDCs on use of equipment within the RHCA would limit the inputs of fine sediment, and although fine sediment may result from implementation of this treatment, the amount of sediment that enters the stream is expected to be trapped by the trees felled and would not result in a meaningfully measurable effect.

Ecological riparian treatments are being proposed for approximately 2,300 acres. Ecological riparian treatments would be implemented in multiple phases. The phases would limit treatments to no more than 25 percent of acreage per subwatershed per year. No consecutive reaches of a given stream would be treated in a given year.

Felling and tipping of trees in the inner portion of the RHCA follow ARBO II guidelines and PDCs for Camp Lick which limit sediment impacts on streams. Because activities associated with large and coarse wood placement in the stream and floodplain would occur first in order to meet large wood desired conditions, wood placed through the completion of inner RHCA work is expected to trap sediment and mitigate the impacts of fine sediment entering the stream as a result of outer RHCA work. Operation of equipment in the outer RHCA during commercial harvest is likely to cause minor damage to outer RHCA soils. An unknown amount of sediment would be mobilized into streams from the upper riparian treatments. A slight increase in fine sediment deposition for a short distance downstream of exposed and disturbed areas is also likely to occur. The intensity and duration of disturbance is unlikely to increase total suspended solids. Wood added to the floodplain and stream and PDCs would minimize sediment delivery and mobilization to near background levels, where delivery to structurally complex streams provides a source of material for the stream to recover from over-widened or downcut conditions present in the planning areas.

Ecological riparian treatments are expected to have a short-term negative and meaningfully measureable effect on sediment and embeddedness due to temporary increases in sediment contributions from heavy equipment use in the RHCA. But would through the addition of instream wood, ultimately have a positive effect in the long term on stream sediment or embeddedness.

Meadow restoration treatments are proposed on approximately 115 acres. Trees felled during this prescription would be placed into, or directly adjacent to, the stream channel. Although fine sediment may result from implementation of this treatment, the amount of sediment that enters the stream is expected to be trapped by the trees felled and would not result in a meaningfully measurable effect.

Headwater restoration treatments, approximately 200 acres, do not propose the removal of large wood within the RHCA and coarse woody debris (downed woody debris) within units would be maintained for potential wildlife use and soil benefits. Headwater restoration treatments would meet the Forest Plan standards for ground cover. Limiting headwater restoration activities to areas outside of category 1, 2, and 4 RHCAs (Figure 10, and **Error! Reference source not found.**) and following Forest Plan ground cover tandards are expected to control soil erosion. However, if soil erosion in the treated areas does occur, fine sediment may be included in the substrate that travels from category 4 intermittent streams to category 1 fish bearing streams. It is expected that these occurrences would happen in pulses and that instream large wood would catch sediment. Areas downstream of headwater restoration treatments have had wood added to them in past projects; wood placed in the streams through past restoration is expected to catch the new sediment introduced to the system from headwater treatments. Furthermore, streams are dynamic systems that are adapted to periodic pulses of large amounts of sediment and organic material, followed by quiet periods during which they absorb, transport, and adjust (Apostol and Sinclair 2012). Thus, although potential increased contributions of fines sediment could have short term negative effect, the effects of the headwater restoration treatment is not expected to be long term or meaningfully measurable. If a mixture of substrate that includes spawning gravel does erode down from the treatment into fish bearing streams, the treatment could have a long term benefit. Furthermore, road crossings that may be effected by potential landslides have been checked by hydrology technicians and would be targeted for maintenance.

Fuels Treatments (Prescribed Burning, Piling and Burning, and Biomass Removal)

Most fuels treatment activities would occur outside of RHCAs. Ignition of prescribed burns could occur 25 feet from the edge of the stream channel (the 25 foot buffer is to prevent drip torch fuel from entering the stream). Fire would be allowed to back into RHCAs from upslope burning units. Most burning activities would mimic low intensity fires that are characteristic of natural burning patterns in riparian areas. These techniques would result in a patchy distribution of burned and unburned areas in RHCAs. Using these techniques, fire intensities would not be high enough to consume downed wood that plays a role in trapping fine sediment. Some ground cover would be consumed but would be quickly replaced as litter fall occurs in the first year following burning and herbaceous plants recover in the second year following burning. A measurable increase in fine sediment in stream channels as a result of low severity burning activities is unlikely due to the combination of a patchy, low intensity burn in RHCAs, typical recovery of ground cover within 2 years of burning, and the low erosion potential for the subwatersheds.

Beche et al. (2005) conducted intense post-prescribed fire monitoring (e.g., pebble counts, longitudinal profiles, and cross-sections) and observed little to no change in stream sediment composition 1 year post-fire. Similarly, they observed little to no change in stream channel morphology and no substantial change in erosion or deposition in the surveyed reaches (Beche et al. 2005).

Temporary Roads and Landings

Under alternative 2, landings and staging areas would not be located within riparian habitat conservation areas (RHCAs), unless approved by district aquatics personnel. Landings within the RHCA would be considered in order to accomplish the ecological riparian treatments if they are historical or existing landings, or are located upslope of a road, and must be approved by the district aquatics personnel. Limiting these ground-disturbing activities to areas outside of RHCAs and to locations that are approved by district aquatics personnel, along with erosion control BMPs, would prevent negative and meaningfully measurable impacts to embeddedness and fine sediment. With implementation of PDCs, construction of most temporary roads would not result in a meaningfully measureable increase in embeddedness and fine sediment.

Only one of the temporary roads is in a RHCA, it is within a category 1 RHCA for approximately 200 feet, and within a category 4 RHCA for approximately 515 feet (with the road ranging a distance of 57-

140 feet away from the stream). The section of temporary road that is within the category 1 stream RHCA is upslope of NFS Road 3675000 which disconnects the temporary road from West Fork Lick Creek and MCR steelhead critical habitat. The temporary road in the RHCA would likely result in creation and transport of a negligible amount of fine sediment to the category 4 stream due to loosening of sediment particles and destruction of ground cover. Separation of West Fork Lick Creek from the temporary road by another road limits the amount of fine sediment likely to enter Wet Fork Lick Creek. These are the only streams where proximity of proposed temporary road work warrants specific discussion due to potential for effects to these indicators (see discussion under Pool Frequency).

Road Decommissioning

The procedure for decommissioning a road would include removing all culverts and reshaping the immediate area. In addition, cross ditches would be constructed to maintain drainage and reduce the potential for surface erosion. These measures would be implemented during decommissioning to hydrologically disconnect roads from streams, thereby reducing sediment entering streams and affecting fish habitat.

There is a short-term risk of generating sediment during and shortly after decommissioning activities that could reach streams, primarily near stream crossings where culvert removal, scarification, or subsoiling is needed to discourage vehicle use and improve infiltration. Bare soil is prone to erosion and can result in fine sediment entering stream channels and resultant increases in turbidity. Habitat impacts are likely to include areas of exposed streambank in isolated locations primarily in the vicinity at stream crossings. Exposed areas and other disturbances that occur are likely to result in a slight increase in turbidity for a short distance downstream during rainstorms or runoff events. However, given background levels of turbidity during runoff events it would be difficult to distinguish between turbidity resulting from this project activity and background turbidity. An unknown amount of sediment would be mobilized into streams. Timing of work outside of the wet season and adherence to all PDCs and BMPs would further limit fine sediment delivery. A slight increase in fine sediment deposition for a short distance downstream of exposed and disturbed areas is also likely to occur. There is the potential for fine sediment to slightly increase embeddedness within gravels suitable for spawning when the gravel is located immediately downstream from road decommissioning sites. Increased embeddedness may also result in a decrease in the potential for production of aquatic macroinvertebrates as discussed above. These impacts are expected to be localized and short-term. Consequently, the effect to embeddedness and fine sediment by road decommissioning is negative and expected to be measureable**.**

Road decommissioning would also have a positive and meaningfully measureable effect on embeddedness and fine sediment due to a lasting but minor decrease in fine sediment delivery to streams as a result of hydrologically disconnecting unneeded roads from the drainage system. Design criteria include those identified in the ARBO II as well as design criteria developed by the Blue Mountain Ranger District interdisciplinary team. The ARBO II PDCs specific to this project would be implemented as described in the ARBO II. Implementation of the PDCs, as well as implementation of any Reasonable Prudent Measures and Terms & Conditions from Endangered Species Act section 7 consultation with National Marine Fisheries Service and the U.S. Fish and Wildlife Service (see Appendix A of this BE, and Camp Lick PEA Appendix C – Project Design Criteria) would reduce the probability and magnitude of this short-term risk. After about 2 years, effects of road decommissioning would be beneficial for water quality and fish habitat. The improved infiltration and ground cover condition of the decommissioned roads, as well as restoration of the energy-dissipating functions associated with floodplain connectivity, would help restore natural watershed function, including reduced sediment yield from the road prism.

Road Maintenance and Use (Haul, Water Drafting, Opening and Road Closures)

Road maintenance would occur at a level commensurate with use, and includes several activities that potentially result in sedimentation from the road prism to the ditch line, or the adjacent slope. Typical road maintenance activities include: blade and shape road including existing drainage dips, grade sags, and waterbars, repair damaged culverts and ditches, place rock in some existing drainage dips and grade sags, place rock in wet areas of road, brush, remove danger trees, and apply dust abatement. PDCs include the rocking of stream crossings to minimize sediment delivery to streams from haul. Machinery would be kept on the road prism.

The longer term effects of road maintenance would maintain or improve existing road conditions. Road maintenance may decrease chronic sedimentation in some locations. Improving drainage, removing ruts and rills from the driving surface, and adding less erosive surfacing material would reduce detachment and transport of sediment. This is especially important for roads within RHCAs. Because road maintenance activities would be commensurate with use, it is possible that if winter logging occurs, little to no road maintenance may be necessary and therefore would not occur. Alternatively, if operations occur in the summer, road maintenance may occur on all or nearly all of the haul roads.

Proposed road maintenance and haul activities in RHCAs would likely result in creation and transport of a negligible amount of fine sediment to stream channels due to loosening of sediment particles and destruction of ground cover. However, PDCs would be implemented during these activities, and are expected to limit fine sediment delivery to streams, keeping amounts reaching stream channels to negligible levels for other than rare precipitation events (negative but not meaningfully measurable).

Water withdrawals for dust abatement during haul would be in accordance with the PDCs, including NMFS guidance. Use of PDCs for water drafting would ensure that water withdrawals do not result in significant delivery of fine sediment to streams.

Road closure actions include construction of drainage structures that would be self-maintaining after closure. Closure of these roads poses a negligible risk of sedimentation to fish-bearing streams since dry land "filtration" lies between the closure sites and any streams, and since the amount of land disturbed during gate construction is too small and too flat to produce significant sediment. However, since these roads are being kept as part of the forest road system, the benefits of the closures would likely not be permanent. Because of the low risk of sedimentation from road closures and reduction in vehicle travel (resulting in vegetation covering the roadbed) effects to embeddedness and fine sediment are expected to be positive but not meaningfully measurable due to the lack of permanency for closures.

Interpretive Sign Installation

The installation of an interpretive sign would be aimed at adding interest and value to the public, describing the Forest's goal of restoring and maintaining a healthy, resilient landscape. The proposed sign would be installed along NFS Road 3600, which parallels Camp Creek. Due to the small scale of these disturbances, no effect related to embeddedness and fine sediment is expected from placing interpretive signs.

Range Improvements (Range Fence Construction)

The proposed fencing would improve stream processes and functions in the long term by reducing or eliminating streambank damage issues in chronically problem livestock management areas. Although the beneficial effects of fencing streams to limit livestock access are clear, some negative effects are expected to occur at the fence-crossing site. Fence construction, and concentration of livestock at these areas can result in streambank damage and add fine sediment to stream substrates. Sediment would likely be

delivered to stream channels as a result of the proposed action; however the amount of sediment would not be of a magnitude to result in meaningfully measurable negative effects to embeddedness and fine sediment.

The net effects of reduced sediment delivery to streams from reduction or elimination of livestock-related streambank damage issues would be positive and meaningfully measureable.

Direct and Indirect Effects – Width to Depth Ratio and Streambank Stability

These indicators are grouped since they are affected similarly by project elements.

Timber felling includes silviculture treatments (stand improvement commercial thinning, lodgepole treatments, stand improvement biomass thinning, western white pine restoration, juniper encroachment treatments, yarding, and danger tree felling.)

Most timber felling activities would have no effect on width to depth ratios or streambank stability due to proximity of most actions away from the stream channel, and implementation of PDCs. The possible minor amounts of sediment entering channels, and small areas of bank instability, would not affect width to depth ratios at the site or reach scale. Effects from these actions on width to depth ratios would be neutral.

Riparian and upland watershed restoration

The addition of wood to streams adjacent to aspen treatments would have positive long-term effects on banks stability and width to depth ratios. Instream wood can catch sediment and help build banks. Aspen treatment activities would contribute sediment that would be stored by wood added to streams and would have discountable effects to width to depth ratios or streambank stability due the scale of the proposed action. The possible minor amounts of sediment entering channels and small areas of bank instability would not affect width to depth ratios at the site or reach scale. Effects from these actions on width to depth ratios would be neutral.

Treatment of the inner portion of the RHCA in ecological riparian treatments could have short term negative effects due to wood placement activities, width to depth ratios may be altered in localized areas where wood is placed. However, the requirement to have machinery work outside of the active channel when feasible would minimize occurrence of bank instability. In the long term, ecological riparian treatments would have positive and meaningful measurable effects on bank stability and width to depth ratio. Large and coarse wood added to streams in this treatment would back up sediment in the stream and build stream banks over time.

Treatments outside the 100 foot buffer but within the 300 foot buffer for category 1 RHCAs that may entail commercial removal are anticipated to have no on effect bank stability or width to depth ratios due to their location away from the active floodplain and adherence to PDCs**.**

Headwater restoration treatments may have positive long-term meaningfully measurable effects to width to depth ratios and streambank stability. If soil erosion does occur as a result of the treatment substrate that washes down from the headwaters, it could help build up banks in streams that are over-widened downstream, especially in areas where instream large wood is present to catch the sediment. If a mixture of substrate that includes spawning gravel eroded down from the treatment into fish-bearing streams, the treatment could increase available spawning areas for fish.

Meadow treatments would have similar positive impacts as ecological riparian treatments, since wood added to streams in this treatment would catch sediment in the stream and build stream banks over time.

Fuels Treatments (Prescribed Burning, Piling and Burning, and Biomass Removal)

A minor short-term decrease in stream bank stability would occur as a result of prescribed burning activities in RHCAs until vegetation recovers. However, it is unlikely that burned patches along stream banks would be in sufficient sizes or quantities to result in a meaningfully measureable decreases in bank stability. These impacts would not be of a scale that would result in destabilization of stream channels, thus a neutral effect to width to depth ratios from fuels treatments is anticipated. Over the long-term, as fire invigorates riparian shrub growth, bank stability would increase in a meaningfully measureable way. No effects to bank stability or width to depth ratios are expected from pile burning and biomass removal, due to proximity of these activities away from stream channels. Grapple or handpiling areas would not be located within RHCAs, except in conjunction with aquatic restoration projects designed for RHCAs.

Temporary Roads and Landings

Under alternative 2, landings and staging areas would not be located within riparian habitat conservation areas (RHCAs), unless approved by district aquatics staff. Landings within the RHCA would be considered in order to accomplish the ecological riparian treatments if they are historical or existing landings, or are located upslope of a road, and must be approved by the district aquatics personnel. Limiting these activities to areas outside of RHCAs and to areas approved by district aquatics personnel would prevent adverse impacts to existing width to depth ratios. Following project PDCs, construction of a temporary road that comes to within 100 feet of a category 1 stream, a tributary to Camp Creek (for approximately 340 feet - see description of temporary roads in Pool Frequency section above) is proposed, but would not damage stream banks or deliver sediment to the degree that effects to bank stability or width to depth ratios would occur (neutral effects).

Road Decommissioning

Road decommissioning would positively affect bank stability and width to depth ratios by obliterating roads that restrict floodplain connectivity. The minor amount of sediment delivered to streams associated with road decommissioning would not affect width to depth ratios. Due to the extent and location of treatments, this effect would be positive and meaningfully measureable.

Road Maintenance and Use (Haul, Water Drafting, Opening and Road Closures)

The possible minor amounts of sediment entering channels from road maintenance activities would not affect floodplain connectivity, streambank stability, or width to depth ratios at the site or reach scale. A neutral effect is anticipated.

Road closure actions include construction of drainage structures that would be self-maintaining after closure (See road closure Table 15). Closure of these roads poses a negligible risk for bank stability and a neutral effect for width to depth ratios to fish-bearing streams, since dry land “filtration” lies between the closure sites and any streams, and since the amount of land disturbed during gate construction is too small and too flat to produce significant sediment. However, since these roads are being kept as part of the forest road system, the benefits of the closures would likely not be permanent. Because of the dryland filtration and distance from the stream, the effects to bank stability and width to depth ratio are expected to positive but not meaningfully measurable due to the lack of permanency for closures.

Interpretive Sign Installation

The installation of an interpretive sign would be aimed at adding interest and value to the public, describing the Forest’s goal of restoring and maintaining a healthy, resilient landscape. The proposed sign would be installed along NFS Road 3600, which parallels Camp Creek. The proposed sign location is on an existing road pull out, sediment contribution from sign installation and viewing would not result in meaningfully measureable effects to bank stability and width to depth ratio.

Range Improvements (Range Fence Construction)

Proposed range improvements in RHCAs would likely result in minor negative effects to stream bank stability; however, these impacts would not be of a scale that would result in destabilization of stream channels or negative effects to width to depth ratios. PDCs would be implemented during these activities, and are expected to limit impacts to bank stability. The net effects of reduced delivery of sediment to streams from reduction or elimination of livestock-related streambank damage issues would be positive and meaningfully measureable for width to depth ratios and bank stability.

Table 17. Summary of project element effects of the Camp Lick Project to the primary habitat elements

Primary habitat elements	Timber felling	Riparian and upland watershed restoration	Fuels treatments	Temp road & landings	Road decom	Road maint. & use	Interpretive sign installation	Range improve-ments
Pool frequency	NNMM **PMM**	NNMM **PMM**	NNMM **PMM**	NNMM	NNMM **PMM**	NNMM	PNMM	NNMM **PMM**
Water temp and stream shading	NNMM	NNMM **PMM**	NNMM **PMM**	NNMM	**PMM**	NNMM	PNMM	NNMM **PMM**
Large woody debris	NNMM **PMM**	NNMM **PMM**	NNMM **PMM**	NNMM	**PMM**	NNMM	PNMM	NNMM
Embed-dedness and fine sediments	NNMM **PMM**	**NMM PMM**	NNMM **PMM**	**NNMM**	**NMM PMM**	NNMM **PMM**	PNMM	NNMM **PMM**
Width to depth ratio	Neutral	NNMM **PMM**	Neutral	Neutral	**PMM**	Neutral	PNMM	Neutral **PMM**
Bank stability	NNMM	NNMM	NNMM **PMM**	Neutral	NNMM **PMM**	Neutral	PNMM	**PMM**

[1] NNMM = Negative, not meaningfully measured
[2] PNMM = Positive, not meaningfully measured
[3] NMM = Negative, meaningfully measured
[4] PMM = Positive, meaningfully measured

Actions included under each project element are

- Timber felling includes silviculture treatments (stand improvement commercial thinning, lodgepole treatments, stand improvement biomass thinning, western white pine restoration, juniper encroachment treatments, yarding, and danger tree felling)
- Riparian and upland watershed restoration (includes aspen restoration, ecological riparian treatments, meadow restoration, and headwaters restoration treatments)
- Fuels treatments (includes prescribed burning, piling and burning, and biomass removal)
- Temporary roads and landings
- Road decommissioning
- Road maintenance and use (includes haul, water drafting, open roads and road closures)
- Interpretive sign installation
- Range improvements (includes range fence construction)

Direct Effects to the Species

The Camp Lick planning area contains MCR steelhead and redband trout spawning, and rearing habitat. At certain times and under various conditions it is possible for components of six project elements to directly affect MCR steelhead or redband trout: road decommissioning, riparian and upland watershed restoration (includes aspen restoration, ecological riparian treatments, meadow restoration, and headwaters restoration treatments), and water drafting. Direct effects to MCR steelhead, redband trout, and western ridged mussels from the remaining project elements are not expected.

For project elements requiring work area isolation through the PDCs, MCR steelhead, redband trout, and mussels may be captured and relocated. Direct effects on juvenile salmonids from work area isolation and fish relocation include mechanical injury during capture, holding, or release, and potential horizontal transmission of disease and pathogens and stress-related phenomena. Stress approaching or exceeding the physiological tolerance limits of individual fish can impair reproductive success, growth, resistance to infectious diseases, and survival. Electro-fishing would be used to salvage fish, and would particularly increase stress loads. Harmful effects of electro-fishing include internal and external hemorrhage, fractured spines, and death. Although some fish may die from electro-shocking, fish would only be exposed to stress caused by work area isolation activities once, and the fish relocation is only expected to last a few hours. Mussels may be affected similarly to fishes, except that salvage would occur prior to use of electrofishing. In the absence of work area isolation and relocation activities, more fish and mussels would potentially be injured or killed because of project activities.

Several conservation measures would be implemented to limit stress and mortality during work area isolation and fish relocation. Limiting the activities to the July 15 to August 15 instream work period would greatly reduce the chance of affecting adult fish, as these periods are designated to avoid times when adult MCR steelhead or redband trout are most likely to be present.

In-water equipment use could temporarily affect MCR steelhead and redband trout, including impacts on redds, smothered or crushed eggs and alevins, blocked migration, and disrupted or disturbed oversummering behavior. MCR steelhead within the John Day River Basin are particularly vulnerable during the spring, when adults are migrating and spawning. Also, they are vulnerable during late spring through early summer when eggs and fry are still present in the substrate. The activities could move juveniles out of oversummering habitats (such as deep pools) and into inferior habitats. However, if using seasonal restrictions imposed by instream work windows, these effects would be avoided. Mussel salvage would minimize the potential for individuals to be crushed by equipment.

Water withdrawals for dust abatement during haul activities would occur. Water is the only agent that would be used for dust abatement for proposed haul activities. Dust abatement typically occurs only during the dry summer months (late June, July, and early August) when road dust is an issue; disturbance of spawning fish is unlikely since fish in the planning area do not spawn at this time. Water drafting could potentially decrease stream flow and thus the amount of water available for fish. Water drafting could also remove fish from the stream or injure them, if they are held against screens. Water drafting can occur only as long as supply is adequate to provide for both fish and withdrawal. Approved screens would be attached to intake hoses to prevent adverse impacts to fish. NMFS developed criteria for pump intake screens would be used on all water pump intakes. Screen mesh openings shall not exceed 3/32 inch for woven wire or perforated plate screens, or 0.0689 inch for profile wire screens, with a minimum 27 percent open area. Trucks would be maintained to prevent oil leaks. Loading would be done in a manner to minimize overflowing and discharge of wash into stream. The maximum withdrawal from one site in an 8-hour period would be 18,000 gallons of water. PDCs include the NMFS criteria and water drafting guidelines from the 2010 Forest Road Maintenance Biological Assessment, and are included in the Camp

Lick PEA, Appendix C – Project Design Criteria. These guidelines would avoid or minimize the potential harm to fish.

The Camp Lick analysis area also contains habitat for Columbia spotted frogs, which are highly aquatic and rarely found far from permanent water. At certain times and under various conditions it is possible for all project elements to directly affect spotted frogs. Due to the implementation of PDCs, the short-term nature of this risk, the timing of ground-disturbing in- and near-water project activities during dry-field conditions (low to moderate soil moisture levels) when spotted frogs are unlikely to be dispersing, and the distance of the vast majority of project sites from permanent water, direct effects on spotted frogs would be minimized.

Direct and Indirect Effects to Aquatic and Riparian Habitat

Use of the six primary habitat elements to determine effects to TES species is based upon using the effects of the action on key habitat elements as a surrogate for effects to the species. The premise is that the primary habitat elements depict the biological requirements of the TES species. Since there is a direct relationship between habitat condition and the growth and survival of individual fish and sensitive species at various life stages, the effects of the action on habitat variables can be linked to effects to individuals of the species, and ultimately to an effect determination.

The analysis in the primary habitat elements section evaluated specific key habitat features that correspond to the primary constituent elements (PCEs) of listed species critical habitat. The PCEs are used to describe "those physical or biological features that are essential to the conservation of the listed species." The same sub-set of key habitat features evaluated for effects to PCEs also apply to the analysis of effects to the species. Those primary habitat element/project element combinations for which a conclusion of effect was "negative and meaningfully measured" are listed below, and have the potential to adversely affect listed MCR steelhead and designated critical habitat. Negative and meaningfully measurable effects do not meet the ESA definition of "insignificant" effects and they are not discountable because the effects are likely to occur. Consequently, the effect determination for MCR steelhead and designated critical habitat is "may affect, likely to adversely affect" (ESA effects); they also may impact individuals or habitat (Region 6 sensitive species effects to western ridged mussel and Columbia spotted frog). These conclusions were found for the following components of the project elements: road decommissioning, and riparian and upland watershed restoration (on a short term basis). The indicators for which "negative and meaningfully measured" effects were concluded are:

- Embeddedness and fine sediment

Ecological riparian treatments are expected to have a short-term negative and meaningfully measureable effect on sediment and embeddedness due to temporary increases in sediment contributions from heavy equipment use in the RHCA. But would, through the addition of instream wood, ultimately have a positive effect in the long term on stream sediment or embeddedness.

The following project elements would also have positive and meaningfully measurable long term effects to three or more of the primary habitat elements as illustrated in Table 17: timber felling, fuels treatments, road decommissioning, and range improvements. These project elements with an aquatic restoration component were included in the NMFS and FWS ARBO II because the long-term effects of improved stream connectivity and habitat conditions far outweigh the short-term adverse effects associated with sedimentation, ground disturbance, and other environmental consequences of these actions. The degree of the potential adverse effects acknowledged in the ARBO II is so limited that it does not rise to the level of significance in the NEPA context because the effect would be short-term and limited in context and intensity.

The scientific literature reports that suspended sediment and turbidity influences on fish range from beneficial to detrimental. Elevated total suspended solids (TSS) have been reported to enhance cover conditions, reduce piscivorous fish and bird predation rates, and improve survival, but elevated TSS have also been reported to cause physiological stress, reduce growth, and adversely affect survival. Although fish that remain in turbid waters experience a reduction in predation from piscivorous fish and birds, chronic exposure can cause physiological stress response that can increase maintenance energy and reduce feeding and growth. Mussels are affected in similar fashion.

As suspended fine sediment settles out downstream from the construction areas, minor increases in stream substrate embeddedness occurs. The scientific literature reports that increases in fine sediments in stream substrates can decrease productivity and habitat quality for juvenile salmonids. Increases in fine sediment levels reduce interstitial spaces between substrate particles, lead to shifts in invertebrate community structure, fill pools, and can entomb redds. In such cases, eggs are smothered, prey available for rearing juveniles is reduced, and habitat features are lost.

When heavy equipment is operating in the riparian areas or stream, there is also the potential for fuel or other contaminant spills. Operation of bulldozers, excavators, and other equipment requires the use of fuel and lubricants which, if spilled into the channel of a water body or into the adjacent riparian zone, can injure or kill aquatic organisms. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain polycyclic aromatic hydrocarbons, which can be acutely toxic to salmonids at high levels of exposure and can cause acute and chronic sub-lethal effects on aquatic organisms.

The Forest Service would implement a suite of PDCs including those identified in the ARBO II that are intended to reduce the short-term effects caused by near instream construction. Limiting instream construction to low flow periods and using sediment control measures has been shown to greatly reduce the amount of fine sediment and turbidity created by such actions. Refueling and servicing equipment outside the riparian area reduces the chances of spilling toxic fuels and lubricants. Development and implementation of a pollution and erosion control plan would limit adverse effects of a toxic material spill by ensuring that spill response materials are on site during all construction activities. Ensuring that all heavy equipment that would operate instream is cleaned and free of leaks would also reduce the introduction of contaminants into the aquatic environment. Also, several conservation measures would be implemented to limit stress and mortality during work area isolation and fish and mussel relocation. Limiting the activities to instream work periods would greatly reduce the chance of affecting adult fish, as these periods are designated to avoid times when adult salmonids are present.

The Camp Lick Project would restore riparian processes and functions resulting in a strong positive effect on aquatic TES and MIS species. Ecological riparian treatments, range improvements, road decommissioning, fuels treatments, and timber felling would all contribute to restoration of both upland and riparian processes and functions, resulting in a truly restorative project touching on nearly every aspect of land management in the Camp Lick planning area.

Effect Determinations

Effect determinations for TES and MIS species are presented below and summarized in Table 18.

MCR Steelhead

Determinations:

- Mid-Columbia steelhead ESA determination (T): May affect, likely to adversely affect (LAA) in the short term. Beneficial effect (BE) in the long-term when combined with foreseeable aquatic restoration actions.

- Mid-Columbia steelhead sensitive species determination (S): may impact individuals or habitat, but will not cause a loss of viability to the population or species (MIIH) in the short term. Beneficial impact (BI) in the long-term when combined with foreseeable aquatic restoration actions.
- Steelhead management indicator species determination (MIS): continued viability at the Forest scale.
- Steelhead designated critical habitat (D): May affect, likely to adversely affect (LAA) in the short term. Beneficial effect (BE) in the long-term when combined with foreseeable aquatic restoration actions.

Because this alternative impacts less than 8.4 percent of suitable MCR steelhead habitat across the Forest, the overall direct, indirect, and cumulative effects (discussed below) would result in a small negative trend of habitat in the short term. The negative effect on habitat would be insignificant at the scale of the Forest. This alternative is consistent with the Forest Plan, and thus continued viability of MCR steelhead is expected on the Malheur National Forest.

- Overall, proposed actions would result in a beneficial effect to neutral effect on habitat conditions for MCR steelhead in the aquatic analysis area. However, high water temperatures and altered stream channel conditions in untreated stream reaches would likely persist.

Redband Trout

Determinations:

- Interior redband trout sensitive species determination (S): may impact individuals or habitat, but would not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species (MIIH) in the short term. Beneficial impact (BI) in the long-term.
- Redband trout management indicator species determination (MIS): continued viability at the Forest scale.

Because this alternative impacts less than approximately 4.6 percent of suitable redband trout habitat in relation to the distribution throughout the Malheur National Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat in the short term. The effect on habitat would be insignificant at the scale of the Forest. As such, the implementation of the project may impact individuals or habitat, but would not likely contribute toward federal listing or cause a loss of viability to the population or species at the Forest scale.

Overall, proposed actions would result in a beneficial impact in habitat conditions for redband trout in the aquatic analysis area. However, high water temperatures and altered stream channel conditions in untreated stream reaches would likely persist.

Pacific Lamprey

Determinations:

- Pacific lamprey sensitive species determination (S): may impact individuals or habitat, but would not likely contribute toward federal listing or loss of viability to the population or species (MIIH) in the short term. Beneficial impact (BI) in the long-term.

Columbia Spotted Frog

Determination:

- Columbia spotted frog sensitive species determination (S): May impact individuals or habitat, but would not likely contribute toward federal listing or loss of viability to the population or species (MIIH) in the short term. Beneficial impact (BI) in the long-term.

Because this alternative impacts a small percentage of suitable spotted frog habitat on the Malheur National Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat in the short term. The effect would be insignificant at the scale of the Forest. The action alternative may impact individuals or habitat, but would not likely contribute toward federal listing or loss of viability to the population or species at the Forest scale.

Overall, proposed actions would result in a beneficial impact on habitat conditions for Columbia spotted frogs in the aquatic analysis area. However, altered stream channel conditions in untreated stream reaches would likely persist.

Western Ridged Mussel

Determination:

- Western ridged mussel sensitive species determination (S): may impact individuals or habitat, but would not likely contribute toward federal listing or loss of viability to the population or species (MIIH) in the short term. Beneficial impact (BI) in the long-term.

Because this alternative impacts a small percentage of suitable western ridged mussel habitat on the Malheur National Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat in the short term. The effect would be insignificant at the Forest scale. Alternative 2 may impact individuals or habitat, but would not likely contribute toward federal listing or loss of viability to the population or species at the Forest scale.

Overall, proposed actions would result in a beneficial impact on habitat conditions for the western ridged mussel in the aquatic analysis area. However, high water temperatures and altered stream channel conditions in untreated reaches would likely persist.

Cumulative Effects

Aquatic Habitat

The cumulative effects boundary is the same as the aquatic analysis area. Past and ongoing actions are described in the Camp Lick EA. Effects of the past and ongoing actions are described in the Affected Environment section above:

- Effects of past and ongoing actions
- General existing stream conditions
- The affected environment sub-sections for pool frequency, large woody debris, bank stability, embeddedness and fine sediment, width to depth ratio, and water temperature and stream shading.

Effects are mostly due to roads (including former logging railroads), past grazing, and past riparian harvest. Lesser effects may be due to current grazing, irrigation withdrawals (temperature), riparian firewood cutting (LWD), and fish passage and habitat restoration projects (sediment).

The aquatic habitat and water quality effects of future activities described in the Camp Lick EA are negligible, except for the ongoing actions mentioned in the preceding sentence. The effects of use and maintenance of roads which are not decommissioned would remain about the same as at present. The effects of past fish passage and habitat restoration projects decreases after instream work is finished, and would likely be negligible within two years after implementation.

With full implementation of Forest Plan grazing standards there is little likelihood of cumulative effects from grazing since these standards are designed to allow a near natural rate of recovery of aquatic habitat

and riparian vegetation. The current grazing standards are designed to eliminate any effects on aquatic habitats that could carry over to the following year.

If a severe crown fire occurs, shade would be reduced, and water temperatures would increase. Sediment would increase from channel and upland sources, and a pulse of woody debris would fall into the streams. Both low flows and peak flows would increase for perhaps 10 years, until evapotranspiration recovers.

The no action alternative would permit natural slow, partial recovery from effects of past grazing, past riparian road construction, and past riparian harvest. This recovery would occur as riparian trees grow larger, as large wood falls into the streams, as channel types change to more stable, narrow configurations, as sediment from past actions is flushed out of stream substrates, and as riparian shrubs and sedges recover and contribute to more stable stream banks. Recovery would be only partial because ongoing impacts from some past land management activities (particularly riparian road maintenance), and the railroad grade within the floodplain, would not permit full recovery nor restore physical processes that facilitate recovery.

The analysis of effects of seven grouped project elements on the six primary habitat elements determined that road decommissioning, and riparian and upland watershed restoration would have a short-term negative and meaningfully measurable effect on the primary habitat element of embeddedness and fine sediment. The analysis determined that the effect of the remaining five project elements on the remaining five primary habitat elements was either negative and not meaningfully measurable or neutral.

All project elements except for: 1) temporary road and landing construction, and 2) road maintenance and use would also have positive and meaningfully measureable effects to three or more of the primary habitat elements (Table 17). The Camp Lick Project would restore riparian processes and functions resulting in an unprecedented positive effect on aquatic TES species. LWD additions done during inner RHCA ecological riparian treatments in Riparian and upland watershed restoration, range improvements, road decommissioning, fuels treatments, and timber felling would all contribute to restoration of both upland and riparian processes and functions, resulting in a truly restorative project touching on nearly every aspect of land management in the Camp Lick analysis area.

Combined Effects from Past, Proposed, Ongoing, and Foreseeable Actions

Common sources of sediment within the analysis area include both natural processes and past and ongoing actions on both National Forest and private lands, such as channel and floodplain modification from railroad logging, channel erosion, past mining, livestock grazing (especially past grazing), and roads. The analysis of effects determined that stream crossing improvements accomplished for haul maintenance, and road decommissioning would have a short-term negative and meaningfully measurable effect on embeddedness and fine sediment. However it is unlikely that these increases would result in cumulative adverse effects when combined with other past, ongoing, or future actions. Sediment production by haul road maintenance stream crossing improvements, road decommissioning, and ecological riparian treatments in alternative 2 would be a small proportion of the total sediment from natural processes and from past and ongoing actions. Design criteria for the project would limit sediment delivery to streams. Thus the cumulative effect of the proposed action would be a relatively small increase in total sediment production.

Ongoing grazing activities could potentially contribute sediment to streams. The effect of the remaining five project elements on the remaining five primary habitat elements was either negative and not meaningfully measurable or neutral. It is unlikely that these negative and not meaningfully measureable effects would result in measurable adverse cumulative effects when considered with range management activities. Sediment production by road activities and road decommissioning in alternative 2 may result in

short-term increases in fine sediment. However, the level of these cumulative effects with grazing management activities is not likely to reach a point where measurable adverse effects would occur where grazing standards are met.

All project elements except for: 1) temporary road and landing construction, and 2) road maintenance and use would also have positive and meaningfully measureable effects to three or more of the primary habitat elements (Table 17). The Camp Lick Project would restore riparian processes and functions resulting in a positive effect on aquatic TES species. Stream crossing improvements that occur during road haul maintenance, ecological riparian treatments, range improvements, road decommissioning, fuels treatments, and timber felling would all contribute to restoration of both upland and riparian processes and functions, resulting in a truly restorative project touching on nearly every aspect of land management in the Camp Lick analysis area. The cumulative effects of these actions when combined with the effects of past, ongoing, and reasonably foreseeable actions are expected to offset the negative effects described above and result in overall beneficial cumulative effects to species habitat considered in this biological evaluation. A strong positive response to habitat and six primary habitat elements is expected. This project is consistent with Forest Plan and PACFISH objectives, and is expected to achieve those objectives in treated areas where not currently met.

Threatened, Endangered, Region 6 Sensitive Species and Management Indicator Species Effects Summary

The following is a summary of both threatened, endangered, and R6 sensitive (TES) species and management indicator species (MIS) effects determinations for alternatives documented from the aquatic biological evaluation for the Camp Lick Project.

Table 18. Threatened, endangered, and Region 6 sensitive species and management indicator aquatic species with effects determinations by alternative

Aquatic species	Status	Alternative 1 (no action)	Alternative 2 (proposed action)
Mid-Columbia River steelhead *Oncorhynchus mykiss*	T,S, MIS	NE NI	LAA- BE MIIH - BI
Mid-Columbia steelhead designated critical habitat	D	NE	LAA - BE
Interior redband trout *O. mykiss gairdneri*	S, MIS	NI	MIIH - BI
Pacific lamprey *Entosphenus tridentatus*	S	NI	NI
Columbia spotted frog *Rana luteiventris*	S	NI	MIIH - BI
Western ridged mussel *Gonidea angulata*	S	NI	MIIH - BI
Shortface lanx *Fisherola nuttalli*	S	NI	NI
Columbia clubtail *Gomphus lynnae*	S	NI	NI

See below reference tables for an explanation of the abbreviations used above.

Table 19. Federal listing status abbreviations

Abbreviation	Federal listing status
T	Federally threatened
S	Sensitive species from Regional Forester's list
MIS	Management indicator species
D	Designated critical habitat
P	Proposed critical habitat

Table 20. Threatened and endangered species effects determinations abbreviations

Abbreviation	Threatened and endangered species effects determination
NE	No effect
NLAA	May effect, not likely to adversely affect
LAA	May effect, likely to adversely affect
BE	Beneficial effect

Table 21. Region 6 sensitive species determinations abbreviations

Abbreviation	Sensitive species determination
NI	No impact
MIIH	May impact individuals or habitat, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species
WIFV	Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species
BI	Beneficial impact

Table 22. Designated critical habitat effects determinations abbreviations

Abbreviation	Designated critical habitat effects determination
NE	No effect
LAA	May effect, likely to adversely affect

Abbreviation	Designated critical habitat effects determination
NLAA	May effect, not likely to adversely affect

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Malheur Forest Plan

Alternative 1

The no action alternative does not fully meet the MA3B standards, and PACFISH standards and guidelines. The no action alternative is not consistent with the following Forest Plan standards:

- MA3B standard 41: "…Minimize the density of opens roads in this management area by obliterating, revegetating, or closing unnecessary roads or any roads causing significant resource damage."
- PACFISH Standard RF-3c: Determine the influence of each road on RMOs. Meet RMOs and avoid adverse effects on inland native fish by:
    - Closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to anadromous native fish in priority watersheds, and the ecological value of the riparian resources affected.

Degraded aquatic habitat conditions that have known adverse impacts to aquatic resources would remain in their current condition under the no action alternative.

Alternative 2

Alternative 2 is consistent with the following applicable MA3B and PACFISH standards:

- PACFISH RF-2b: proposed temporary roads and landings and staging areas in RHCAs are minimized.
- PACFISH RF-3a & b: roads that will be used for proposed vegetation management activities will have drainage problems repaired and will be brought up to standards prior to haul.
- PACFISH RA-2: danger trees felled in RHCAs and outside of the road way will be left on site where woody debris objectives are not being met.
- Forest Plan DFCs/RMOs: activities proposed under alternative 2 would not retard the attainment of Forest Plan RMOs for aquatic habitat (LWD, replacement LWD, pool frequency, bank stability, width to depth ratio, sediment and substrate, shading, and water temperature). Design criteria will be used to minimize the amount of fine sediment resulting from proposed activities.
- Design prescribed burn projects and prescriptions to contribute to the attainment of RMO's (PACFISH standard FM-4).
- Prohibit storage of fuels and other toxicants within RHCAs. Prohibit refueling within RHCAs unless there are no other alternatives. Refueling sites within a RHCA must be approved by the Forest Service and have an approved spill containment plan (PACFISH standard RA-4).
- Locate water drafting sites to avoid adverse effects to listed anadromous fish and instream flows, and in a manner that does not retard or prevent attainment of RMOs (PACFISH standard RA-5).
- Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of RMOs, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to log-term

ecosystem function, listed anadromous fish, or designated critical habitat (PACFISH standard FM-1).

Clean Water Act

All alternatives comply with the Clean Water Act and the Forest Plan, since none raise water temperatures, and since all follow best management practices (BMPs) as specified in "Forest Service R6 general water quality best management practices" (1988), and in standards and guidelines in the Forest Plan. The site-specific BMPs are listed in Camp Lick PEA Appendix C, in PACFISH standards and guidelines (as described earlier in the Regulatory Framework section), in Camp Lick PEA Appendix C, and in standard timber sale contracts.

Endangered Species Act

The Endangered Species Act (ESA) requires the Forest Service to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the FWS or the NMFS if a proposed activity may affect the population or habitat of a listed species. Federally listed fish species and their designated critical habitat in the planning area subject to consultation include bull trout and their designated critical habitat, and Mid-Columbia River steelhead and their designated critical habitat. The NMFS and FWS ARBO II addresses consultation on aquatic restoration actions proposed in the Camp Lick Project. The MNF has initiated ESA section 7 consultation with the FWS and NMFS on the remaining actions of the Camp Lick Project, and expects to provide the regulatory agencies with a biological assessment regarding effects of the project to MCR steelhead, and their designated critical habitats. The completed biological assessment and consultations will be located in the project file.

Magnuson-Stevens Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires the inclusion of Chinook salmon essential fish habitat (EFH) descriptions in Federal fishery management plans. In addition, the MSA requires Federal agencies to consult with NMFS on activities that may adversely affect EFH. EFH consultation with NMFS regarding effects of the proposed action on EFH for Chinook salmon is occurring concurrently with ESA section 7 consultation.

Floodplains (Executive Order 11988)

Executive Order 11988 says that Federal agencies shall avoid direct adverse effects to floodplains or minimize potential harm. Floodplains several feet wide occur along much of the Middle Fork John Day River and its tributaries within the aquatic analysis area. The floodplains are well within RHCAs, and so all alternatives avoid adverse effects to the floodplains, and thus are consistent with Executive Order 11988.

Recreational Fisheries (Executive Order 12962)

Alternative 1

The no action alternative would maintain the current degraded aquatic habitat conditions. The current aquatic habitat conditions are resulting in reduced recreational fishing opportunities.

Alternative 2

Alternative 2 includes a suite of aquatic habitat conservation and restoration action that would improve quantity, function, sustainable productivity, and distribution of recreational fisheries by reducing impacts from elevated levels of fine sediment as directed under Executive Order 12962, Recreational Fisheries.

Other Relevant Mandatory Disclosures

Irreversible and Irretrievable Commitments of Resources

Irreversible effects are not expected. Reduced population viability for MCR steelhead, redband trout, Columbia spotted frog, and western ridged mussel is not expected. PACFISH established explicit goals and objectives for anadromous fish habitat condition and function. By following PACFISH standards and guidelines as well as design criteria specific to this project, it is believed that irretrievable commitments of this resource can be avoided. The goal is to achieve a high level of habitat diversity and complexity through a combination of habitat features.

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Appendix A – Region 6 Stream Survey Data

Table 23. Summary of available R6 stream survey data vs. fish habitat standards for streams within allotments Camp and Lick Creeks

PIBO data[1] (Bold) *R6 survey protocol (Italics)* ***Both (bold & italics)***	**R6 level II stream survey data**				**PAC FISH RMO**	**Amend 29 DFC**	**NMFS matrix of pathways and indicators Ranges of criteria - Properly functioning**	**NMFS matrix of pathways and indicators Ranges of criteria- At risk**	**NMFS matrix of pathways and indicators Ranges of criteria- Not properly functioning**
Stream name	**Camp Creek reaches 3-4**	**Camp Creek reach 3**	**Lick Creek reach 1**	**Lick Creek reach 1**	-	-	-	-	-
Pasture name	Camp Cr Riparian	Camp Cr Riparian	Camp Cr Riparian	Camp Cr Riparian	-	-	-	-	-
Survey date	2004 (Aug 3-Sept 10)	1994 (June 29-July 26)	2004 (Aug 21 – Sept 11)	1994 (June 30-July 8)	-	-	-	-	-
Sample type	**-**	**-**	-	**-**	-	-	-	-	-
6th field HUC	170702030207	“”	“”	“”	-	-	-	-	-
Average bankfull (B) and/or wetted (W) width (feet)	B 29.5 W 14.6	B 29.2 W 18.7	B 15.6 W 9.2	B 14.7 W 9.6	-	-	-	-	-
Average gradient (%)	2.1	2.0	2.4	3.0	-	-	-	-	-
Residual pool depth (feet)	1.6	1.2	1.3	1.1	-	-	-	-	-
Pool frequency (#/mile)	17.5	23.0	32.0	39.3	96[2] 56[3] 47[4] 26[5]	75-132[2] 38-66[3] 30-53[4] 15-26[5]	Meets pool freq & LWD recruitment standards channel width # pools/mile 5 feet 184 10 " 96	Meets pool freq standards but not LWD recruitment	Does not meet pool freq standards

Commented [GR-F1]: Sorry I couldn’t change this part of the table without it getting to complicated

PIBO data[1] (Bold) *R6 survey protocol (Italics)* ***Both (bold & italics)***	**R6 level II stream survey data**				**PAC FISH RMO**	**Amend 29 DFC**	**NMFS matrix of pathways and indicators Ranges of criteria - Properly functioning**	**NMFS matrix of pathways and indicators Ranges of criteria- At risk**	**NMFS matrix of pathways and indicators Ranges of criteria- Not properly functioning**
							15 " 70 20 " 56 25 " 47 50 " 26		
Pool Quality	No >1m deep pools, max spot temp 72.0F	No >1m deep pools, max spot temp 78.0F	No >1m deep pools, max spot temp 73.0F	No >1m deep pools, max spot temp 66.2F	-	-	Pools >1m (3.28ft) deep, good cover, cool water, minimal filling	Few >1m pools or inadequate cover/temp, moderate filling	No >1m pools & inadequate cover/temp, major filling with sediment
Percent Pools	15.0	24.1	17.0	20.4	-	-	-	-	-
Bankfull (B) or Wetted (W) W/D Ratio	B 32.8 W 26.3	B 21.2	B 23.0 W 29.8	B 14.3	<10[6]	<10[6]	<10[7]	10-12[7]	>12[7]
D50 (mm), or Dominant Substrate & Embeddedness	111.1	Cobble, Embeddedness not >30%	44.0	Cobble, Embeddedness >30%	-	Embedded <=20%	Dominant substrate gravel (2-64 mm) or cobble (64-256 mm) (interstitial spaces clear), or embeddedness <20%	Gravel or cobble subdominant, or embeddedness 20-30% if dominant	Bedrock, sand, silt, or small gravel dominant, or embeddedness >30% if gravel or cobble dominant
Pct Fines <2 mm in Riffles (R) or Pool Tails (P)	R 4.0	-	R 12	-	-	-	<12% fines[8] in gravel	12-20% fines[8] in gravel	>20% fines[8] in gravel
Percent Stable Banks (CS & FB)	98.0 measured on 90 percent of reaches	99.0	99.3 measured on 99% of reach	99.7	>80	>90	>90% stable	80-90% stable	< 80% stable
Percent Stable Banks (CS, FB, US)	-	-	-	-	-	-	-	-	-

PIBO data[1] (Bold) *R6 survey protocol (Italics)* ***Both (bold & italics)***	**R6 level II stream survey data**				**PAC FISH RMO**	**Amend 29 DFC**	**NMFS matrix of pathways and indicators Ranges of criteria - Properly functioning**	**NMFS matrix of pathways and indicators Ranges of criteria- At risk**	**NMFS matrix of pathways and indicators Ranges of criteria- Not properly functioning**
Percent Undercut Banks	-	-	-	-	>75	50-75% undercut[9]	-	-	-
Large Wood Frequency (#/mi)[14]	7.0[10], fair recruitment	13.7[10]	8.0[10]	17.9[10]	>20[13]	20-70[10] 80-120[11] 100-350[12]	>20[13] and adequate sources for recruitment	>20 but lacks recruitment to maintain	<20 and lacks recruitment
Percent Shade/Canopy Closure	34.7	18.0	67.7	45.2	-	40-55[15] 50-65[16] 60-75[17] 80[18]	-	-	-
Greenline Wetland Rating	-	-	-	-	-	-	-	-	-
Greenline Woody Cover	-	-	-	-	-	-	-	-	-
Physical Man-made Barriers[19]	Numerous log weirs that may restrict juveniles	Numerous log weirs that may restrict juveniles	Numerous log weirs that may restrict juveniles	Numerous log weirs that may restrict juveniles	-	-	Any in watershed allow passage @ all flows	Any don't allow passage @ base flows	Any don't allow passage @ range of flows
Off-channel Habitat & Refugia	Side channels on 5.0 percent of reaches	-	Side channels on 2 percent of reach	-	-	-	Low energy backwaters & side channels	Some backwaters & high energy side channels	Few or no backwaters

Notes: 1) All PIBO data units converted from metric to English except for mm measurements; **2)** Channels of <10 feet in width; **3)** Channels of >10 to 20 feet in width; **4)** Channels of >20 to 25 feet in width; **5)** Channels of >25 to 50 feet in width; **6)** Criteria is for wetted W/D ratio; **7)** Criteria is for bankfull W/D ratio; **8)** Fines defined as <0.85mm in gravel; **9)** In non-forested systems with 2% or less gradient; **10)** In Ponderosa pine ecosystems (at least 12 inches in diameter and 20% > 20 inches in diameter; and at least 35 feet long or 1.5 times bankfull width); **11)** In mixed conifer ecosystems (at least 12 inches in diameter and 20% > 20 inches in diameter; and at least 35 feet long or 1.5 times bankfull width); **12)** In Lodgepole pine ecosystems (at least 6 inches in diameter and 10% > 12 inches in diameter; and at least 18 feet long or 1.5 times bankfull width); **13)** LWD defined as >12 inch diameter and > 35 ft length; **14)** Stream surveys conducted in 1995 and earlier **a)** included not only LW material within the bankfull channel, but also leaning trees that have the potential to fall into the stream, and **b)** included a "Brush" LWD category that is not considered functional LWD as per Amendment 29 DFCs and the MPI unless in Lodgepole Pine ecosystems. Stream surveys conducted in 1996 and later **a)** only included trees actually within the bankfull channel interacting with stream flow during bankfull conditions, and **b)** included a "Small" LWD category that is not considered functional LWD as described above; **15)** In Ponderosa pine ecosystems; **16)** In mixed conifer ecosystems; **17)** In Lodgepole pine ecosystems; **18)** In hardwood/meadow complexes; **19)** Culvert barrier data from MNF Culvert Assessment GIS layer.

Appendix B – Photographs

The following photos depict representative photos of specific stream reaches within the Camp Lick planning area.

Commented [ADJ-2]: Check with Sasha, but instead of putting the photos in an appendix for Magone they were within the document in the section that talked about the different habitat elements in the project area –representative photos of what is considered good habitat vs degraded as examples for indicators –I see a lot of not good photos below, try to put some good in too

Commented [FS-3R2]: The photos are okay here, with the timeline on the project don't worry about spending time moving them somewhere else.

Figure 14. Tributary to Big Rock Creek (outlet of tributary, pointing to outlet (Figure 15) and inlet (Figure 16) above the road)

Figure 15. Tributary to Big Rock Creek (outlet above the road)

Figure 16. Tributary to Big Rock Creek (inlet above the road)

There were a lot of small trout in this stream, downstream of the culvert. The culvert on this tributary to Big Rock Creek is a barrier to juvenile fish migration, and the inlet needs to be cleaned out. The current proposal to fix this culvert issues is to have the culvert removed and to storm proof NFS Road 3600584 at this location. This road is proposed for haul.

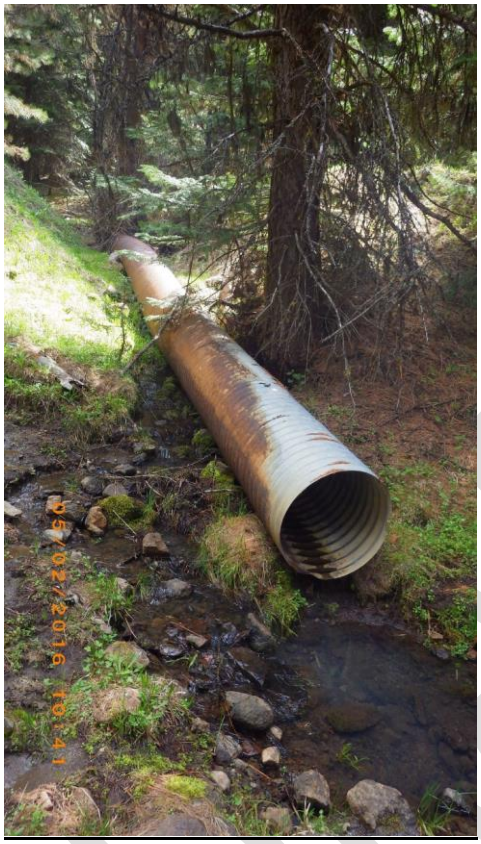

Figure 17. Eagle Creek exposed pipe at 44.57763, -118.83976 (exposed pipe outlet/downstream)

Figure 18. Exposed pipe, view standing on bank

Figure 19. Inlet of pipe

In Figure 17, Figure 18, and Figure 19 it looks like the road fill was taken out and the pipe was left. It is a seasonal barrier, with flows above and below the pipe. There is a spring downstream of the pipe.

Proposed action: remove the pipe. The area can be accessed via a closed road off NFS Road 3600189 (closed road had no number in GIS and is hard to see on fire map).

Figure 20. Eagle Creek culvert on NFS Road 3600189, proposed for decommissioning

Figure 21. Eagle Creek culvert outlet on NFS Road 3600189

Figure 22. Existing berm on closed road

Figure 23. Outlet upstream of inlet

Proposed action: remove culvert and storm proof the crossing, if possible fell trees into the stream culvert and stormproof the crossing, and if possible fell trees into the stream.

Figure 24. Photos above: outlet of Eagle Creek culvert on NFS Road 3650478 (no Camp Lick proposed actions on road). The perched pipe is a 3 foot jump, still in critical habitat. It is a 2 foot diameter pipe. There is nice gravel in the stream around here, good rearing habitat upstream of the culvert, and 0.41 miles of fish bearing stream above this.

Figure 25. Culvert on Coxie Creek, NFS Road 3645273, first culvert present on stream, the culvert is undersized and the inlet is a seasonal barrier to fish migration

Figure 26. Culvert on Coxie Creek, NFS Road 3645273 (culvert outlet)

Figure 27. Culvert on Coxie Creek, NFS Road 3645273 (culvert inlet)

Figure 28. Culvert on Coxie Creek, NFS Road 3645273 (upstream of culvert)

for the greatest good

Figure 29. Top: Second culvert on Coxie Creek, NFS Road 3645273, fish barrier due to jump height and plugged inlet; Right: close up of culvert outlet

Figure 30. Above: plugged culvert inlet on second culvert on Coxie Creek, NFS Road 3645273; Left: Upstream of the culvert

Proposed action: remove culvert and stormproof the crossing. This is located on a closed road.

Figure 31. Photos above: culvert on Coxie tributary (44.55924, -118.84641) NFS Road 3600155

Figure 32. Downstream from the culvert

Culvert is undersized; the road is sloughing down where the culvert is. Also, the road has a berm on it approximately 100 feet after it crosses the channel. There is good gravel coming in from this tributary into the main steam. Aquatic biota surveys also found fish in this tributary.

Figure 33. Culvert outlet on NFS Road 3660565, adjacent to Pepper Creek

Figure 34. Plugged culvert inlet on NFS Road 3660565, adjacent to Pepper Creek (a 6-foot hole has formed near the inlet)

Figure 35. Inlet plugged and large hole (location: -118.87577, 44.63926)

Figure 36. Upstream of the inlet, the main road has been rocked and the stream is washing over the road and down the drainage of the road

Figure 37. Sulphur Creek headcut where road fill pulled, decommissioned NFS Road3600268 off NFS Road 3600686

Figure 38. Cattle being herded on adjacent road

Figure 39. Culvert outlet

Figure 40. Head cut and bank, looking upstream

Figure 41. Culvert inlet

Proposed action: remove culvert on decommissioned road.

for the greatest good

Figure 42. Coxie Creek location protected with downed wood compared with Figure 43 location without downed wood

Figure 43. The springs that are not protected by downed wood show evidence of cattle damage (a lot of hove prints in the ground around the spring and bank stability seem to be negatively impacted)

Figure 44. Big Rock Creek with riparian hardwoods

Figure 45. (Photos left and above) Big Rock Creek without instream wood or hardwoods. Evidence of cattle damage (hoof prints)

Figure 46. Culvert to tributary on Cottonwood Creek is small and undersized, and fine sediment is backed up just upstream of culvert

Figure 47. Culvert inlet; see Figure 50 for likely cause of sediment flush

Figure 48. Culvert requires a 0.5 foot jump, which makes it a potential juvenile fish barrier (although not on a fish bearing section of stream, it is still a category 2, perennial stream and has the potential to have fish)

Figure 49. (Photo above) Upstream of inlet main channel on right side of the picture is being filled in; (Below) Downstream of inlet

Figure 50. Culvert on Tributary to Cottonwood Creek NFS Road 1800785 (top left) and outlet, perched culvert (top middle); headcut (top right), downstream of culvert standing in channel for scale (bottom left), and downstream of culvert (bottom middle); and culvert inlet with sediment accumulated (bottom right)

Figure 51. Tributary to Whiskey Creek, with headcut downstream of perched culvert on NFS Road 3600517; (top left): View standing in stream looking up at road Dominate substrate is gravel cobble; (top middle): Outlet, 2-foot jump, intermittent stream; (top right): About 100 meters downstream of the culvert there is a head cut and the channel is incised below the head cut; (bottom left): Headcut continues down to the confluence with the main channel; (bottom middle): Confluence of tributary and Main Whiskey Creek; and (bottom right): Whiskey Creek at the confluence, channel is incised

Figure 52. Whiskey Creek culvert on NFS Road 3600517: (top) Culvert outlet that is a fish barrier, where there were three 2-inch fish and one 4-inch trout in the pool below the culvert; and outlet pool maximum depth was 2.6 feet (8/31/16), right next to pipe the depth was 0.4 feet, the water temperature was 15 degrees Celsius; (photo bottom left) Culvert inlet, (photo bottom right) upstream of culvert

Figure 53. Beaver dam analog (BDA) and large wood in the stream

Figure 54. Camp Creek beaver dam analogs woven with hardwoods (10/28/16)

Figure 55. Close up of BDA that has had hardwoods planted and woven into it

Figure 56. BDA that is woven, image shows a pool of water being backed up upstream of the BDA (enhancing water storage), a small riffle below the BDA, and then and other pool downstream

Figure 57. Recently built beaver dam on Lick Creek (picture taken 10/28/16), construction observed to be started a couple weeks before

Figure 58. Beaver activity on Camp Creek forming pools and contributing to water storage

Figure 59. Beaver dam on Camp Creek Tributary

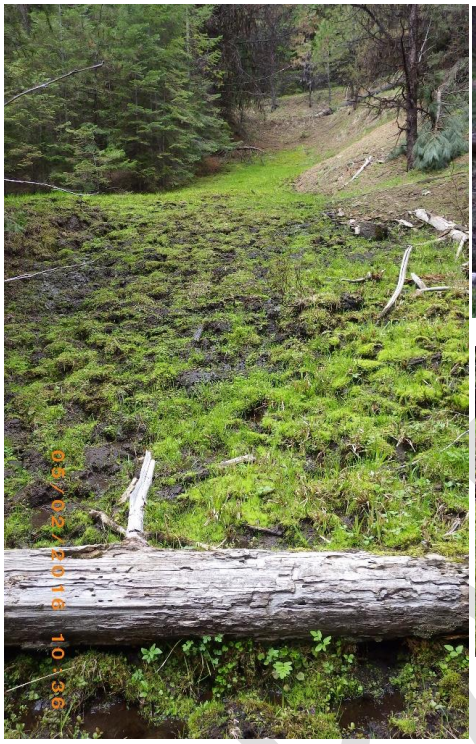

Figure 60. Eagle Creek reach 1 cattle damage